ENGINEERING NEWS

WE rejoice to learn that the letter ballot of the Master Car Builders' Association has confirmed by some 30 votes more than the necessary two-thirds majority, the action had at their late convention making the Janney *type* of coupler (which includes some six or eight different devices which intercouple with each other, or can be made to) the standard of the Association. Thus this much vexed and most important question is finally settled as a mechanical problem, and settled, we are satisfied, in the best and wisest way; in fact, in the only way which would have been either permanent or satisfactory.

The vote has not yet been officially counted (it is being counted as we go to press) and there may be a change of four or five either way when the official result is declared, but it appears to stand about as follows:

Total vote cast	675
Necessary to adopt the standard,	450
In favor of adoption	480
Opposed to adoption	195

That there should have been so large an opposing vote is, under the circumstances, both surprising and discreditable, but it is chiefly made up of those roads which have already committed themselves in favor of some link coupler, and hence have a moneyed interest in not having their action overthrown. Of these roads by far the most conspicuous are the New York Central and its allied lines, which, if all the lines which are more or less influenced by it be included, makes up nearly a full half of the adverse vote. The total vote is not a large one, the possible vote being in the neighborhood of 850, but the Association has never succeeded in casting anything like a full vote, and most of the votes which have not been cast at all, are those cast by individuals, and not the representative votes which depend on number of cars.

THE North American Association of Railroad Superintendents held their semi-annual meeting in this city the past week. It is not a very strong association, but 25 or 30 members at least may be counted on to appear and its proceedings are often instructive. The committee on Frogs reported emphatically in favor of spring frogs, and the committee on Transportation in favor of a demurrage charge of 50 cts. per day for delays of cars over 48 hours. A circular of track inquiries was ordered sent out, and the very interesting and remarkable progress of telegraphing from moving trains was described and commented on as its importance deserves.

ANNOUNCEMENTS have just been made that a permanent Technical Exhibition under Government auspices is now open in St. Petersburg at which American exhibits will be welcome. Exhibitors have certain special privileges and Government guarantees and exemptions which seem to make it a desirable opportunity for those of our manufacturers who have tools, inventions or products which can be advantageously pushed in Russia. We have no advice as to how grand an affair it is, or is to be, but anything backed by the Russian Government is apt to be carried through in good shape, and the personal presence of exhibitors is not necessary to protect their interests.

Mr. A. WARSCHAWSKY, 14 Dey street, New York, is the General Agent for North and South America, and further information can be obtained of him by those interested. We do not feel well enough informed as to the precise scope and promise of the enterprise to describe it more in detail, but we judge that some of our manufacturers would do well not to neglect it.

THE following items from the Brooklyn *Eagle* of Oct. 11 is worthy of note as illustrating the inevitable danger from frogs and switches when introduced in a main track over which trains pass every 90 seconds:

"Last night about 8 o'clock the forward truck of a car, being switched in the Brooklyn station of the bridge jumped the track and caused half an hour's delay. During this time trains were run by locomotives. Scarcely had traffic been resumed when another train got off the track and a similar delay resulted. This form of accident has become very frequent on the bridge."

Naturally it has become frequent, because no care can prevent such accidents when trains are run as close upon each other as it is physically possible. The derailments above described can never do much damage, because they happen only to empty trains out of service while being switched from one track to another, but the possible consequences of the very same accidents, if happening to crowded trains passing over switches in the face of opposing trains, ought not to need comment. And if they do, we do not propose to make any.

A GENERAL plan and site has been presented to the Sinking Fund Commissioners of New York City for the new Criminal Court Building. Five premiums ranging from $1,000 to $5,000, have been offered for plans to be submitted before March 1. These buildings are to be erected in the City Hall Park, and in the form of two wings, making with the present buildings an open square in the rear of the City Hall. The engine house and old Hall of Records will be removed. Mayor Hewitt favors following the architectural features of the old City Hall in the new buildings; which is a good suggestion as the old building is a very pleasing example of the architecture of several generations ago, and there would be more unity in the mass of structure

THE Connecticut grade crossing question is still undecided, and in response to requests of the people of South Norwalk and other towns to call a special meeting of the Legislature to frame laws relieving the citizens of their present responsibility for half the cost of elevating track, Gov. LOUNSBURY says he desires further information before acting. The Governor will request the Railroad Commissioners to render no decision while he has the matter under consideration, but if they do otherwise he will act promptly.

CHICAGO, too, is showing a live interest in the grade-crossing question in that city. But the *Tribune* properly objects to a proposed ordinance which if passed would permit the passage of trains at a greater rate of speed than at present simply by just providing each crossing with substantial fences at the sides and gates, bells and watchmen, all at the company's expense. The *Tribune* wants viaducts as the only safe method of crossing a street, and leaving the railroad company untrammelled as to speed. It thinks that no concessions should be made to the railroad companies in point of speed of traffic until they agree to construct viaducts at the principal streets. This is well as far as it goes, but as the citizens are quite as much interested in the safety of such crossings as are the railroad companies we can hardly agree with the final conclusion of our contemporary that the railroads should pay all of the expenses of making a change to meet conditions that did not exist when the road was built. If the corporations are richer now than they were, so are the cities passed through, and both should share equitably in the increased cost of meeting the increased demands of the present day.

THE proposed sinking of the tracks of the New York and Harlem R. R. Co., in the 23rd and 24th wards, of this city, at an estimated cost of $2,000,000, has developed considerable opposition on the part of residents of that section. It seems they want the company to spend about $500,000 additional in reducing the gradients on streets crossing the tracks.

THE most serious railroad accident of the week was that on the Chicago & Atlantic Railroad, noted elsewhere. During the week there have been two more accidents due to misplaced switches: one Oct 8 on the Gulf, Colorado & Santa Fé Railroad at Temple, Tex., in which the engine was thrown down an embankment; the other Oct. 11 on the New York, Pennsylvania & Ohio Railroad at Warren, O., in which an express train was turned on to a track where a freight train was standing; two men were seriously injured.

THE following bridge accidents are reported: On Oct. 5 a wooden trestle on the Burlington & Missouri River Railroad, 12 miles from Lincoln, Neb., was burned by incendiaries. An approaching train was signaled in time.——On Oct. 8 the bridge across the Pease river at Wichita Falls, Tex., was so damaged by the flood that trains could not cross.——On Oct. 9 a west-bound freight train on the Texas & Pacific Railroad broke through the bridge over the Sabine river, Texas, throwing the rear cars into the water. One man was killed.

DURING the week there have been heavy rains and floods in Texas. The Rio Grande Railroad has been flooded for 6 miles and washouts have occurred on the San Antonio & Aransas Pass Railroad.

THE New York, Providence & Boston Railroad has started a little innovation for which a good deal may be said; it is having its track-walking done by the aid of velocipede hand-cars. From one point of view it is better that men should walk, because they go more slowly over the track, but by using a car they get around, more quickly, and do not have so much of their attention distracted by the mechanical work of walking. Special inspections by these light hand-cars is common enough, but doing regular track-walking work by them is something of a novelty.

THE Vandepoele system of electric street car propulsion, at Appleton, Wis., is said to be a success. The current is generated by water power, and supplied through a traveling carriage running on an overhead conductor. It is now proposed, at some increase of expense, to dispense with the latter. We judge the line is not so successful, however, but that it would be ruined by using steam-power instead of water-power.

ACCORDING to the *Manufacturer's Record*, in the last nine months 2,594 new enterprises have been inaugurated in the "New South," representing a nominal capital of $212,455,000. Among the chief of these we note 26 iron furnaces, 80 machine shops and foundries, 98 flour mills, 59 cotton mills, 65 waterworks, 53 electric light companies, 141 brick works, 56 miscellaneous iron works, 46 natural gas companies, and 444 mining and quarrying companies, and 512 lumber mills. The *Record* says that since 1872 15,000 new enterprises have been started, 15,000 miles of railway built, and the iron production has increased from 397,000 to 876,000 tons.

THE Pennsylvania Company has created a new position—that of legal agent. His duties are to look after all details in cases of wrecks, accidents or deaths on the lines of the road, and report to the company and make arrangements with the Coroner in cases where trainmen will have to appear as witnesses. Marshal HOUGHTON, of Pittsburg, has been appointed legal agent on the Pittsburg Division.

A BUFFALO, N. Y., correspondent states that in the residence portion of that city the asphalt pavements are swept by hand without previous sprinkling. A sufficient number of men are hired at $1.50 per day, and each man is given two blocks to keep clean, a wheel-barrow, a shovel and a rattan broom being provided for each. This man is going backward and forward over his portion of the street all day, removing all dirt and deposit. The only trouble lies in the fact that the contractor for removing the sweepings comes along only twice in the week, and in the meantime the dirt must accumulate in piles before someone's door. No sprinkling is really needed in this system, and the streets are always dry and clean. With a proper receptacle provided for the sweepings this scheme would work admirably.

Street Cleaning Commissioner JAMES S. COLEMAN, in compliance with a request of the Mayor, sends in a list of 137 places where the work of the Department is interfered with either by surface or subway work and piles of dirt and refuse. In 39 places the streets are torn up by the Standard Gas Co., and on 60th. St. between 4th, and 5th. avenues

the street from curb to curb is covered with sand from excavations made by the Steam-Heating Co. Obstructions left by builders and surplus paving material along the path of street-paving constractor BAIRD come in for their share of denunciation in the long list presented. In this connection the Corporation Counsel, in answer to the Street Committee of the Board of Alderman, says:

"I have no means of advising you whether existing ordinances are disregarded or insufficient to prevent the displacement of the pavements without permission of the Common Council or Commissioner of Public Works; for such information as that I must refer your committee to the Department of Public Works.

"The general power of your Board to determine when and to what extent the pavements may be displaced and the streets opened, I have defined as far as may be in the absence of a specific state of facts presented for my consideration. Whether new and more stringent ordinances are necessary is a question to be decided by the wisdom of your body. Should your Board decide that such are necessary I have no doubt they can be lawfully passed and enforced provided they are reasonable in their requirements and do not abridge the rights acquired in the streets by the companies under the laws of the State.

"If the proposed ordinance introduced by Alderman CONKLING should be adopted, I should be glad to bring an action against the New York Steam Company upon its bond, upon evidence showing breach of condition of the bond by that company."

This is not very definite either as to the rights of the city or the infringement of these rights by the companies affected. But we see in them grounds sufficient to warrant making formal charges against the offending parties and by a test-case ascertaining just what control the city does have over its streets.

A REPORT from the Montreal Harbor Commissioners recommending the construction of a boom across Lake St. Louis to prevent the ice coming down, has been approved by Chief Engineer PERLEY of the Public Works Department, and will probably take effect. Lake St. Louis debouches into the Lachine Rapids, eight or nine miles above Montreal. The theory is that at present the lake ice breaks up in the spring earlier than the river ice opposite Montreal, and, descending the rapids, jams the St. Lawrence opposite or below the city and causes the floods. The Harbor Commissioners' report recommends the construction of 19 piers across the foot of Lake St. Louis, the piers to be each 30 ft. square, and connect them with three-ply booms. This, it is believed, will hold the spring ice. The estimated cost of the work is put at $600,000, and the operations are to begin immediately.—*Montreal Star.*

M. DE BLOWITZ, the Paris correspondent of the London *Times* and one of the warmest backers of M. DE LESSEPS and the Panama Canal, now acknowledges in a letter that, owing to the unpatriotic action of the French Chamber of Deputies, which has compelled M. DE LESSEPS to borrow money at 8 instead of 4 per cent., certain changes will probably be made in the plans. M. DE LESSEPS in considering the interests of bondholders will open the canal before it is finished. And to do this the canal will not be excavated to the full width and depth at first, but will still be navigable to large vessels. M. DE BLOWITZ, however, indignantly denies that M. DE LESSEPS has consented to the adoption of the lock-system. While the bondholders of the Panama Canal have our sympathies and we would be glad to see this colossal feat of engineering brought to a speedy and successful end, we fear that the scheme outlined hardly promises success or dividends. It may for the time being check outlay and a further call for assessment upon shares, but the ultimate result of a narrow sea-level channel and too steep slopes will probably be the stoppage of all traffic by land-slides, and once stopped even the magnetism of a DE LESSEPS will hardly suffice to put this huge enterprise into motion again. That is, if M. DE LESSEPS persists in his sea-level canal; with a system of lock something might be done in hastening the opening of the canal to traffic. But if half the truth be told of water-charged, slipping strata, tending to close the cut necessary for the purposes of the canal, decreasing the width of the canal and adding to the weight of the sides by the steeper slopes will only hasten disaster. Even under best conditions the three years now specified (that is not 1889 but 1891) for the completion of the temporary work will not suffice. If opened at all we expect to see it done by locks, despite the denial of M. M. DE LESSEPS and DE BLOWITZ.

Lachine Bridge, Canadian Pacific Railway.

We complete in this issue our illustrations of this fine bridge by giving on the inset sheet and elsewhere a general elevation, strain sheet and make-up diagrams for the most interesting spans of the structure, the channel and flanking spans, and sundry details of the floor system. For these drawings we are indebted to Mr. FRANK D. MOORE, Chief Asst. Engr., St Louis, Mo.*

The strain sheet was computed on the following basis:

Dead Load, 29,000 lbs. per truss per panel for flanking spans; 38,000 lbs. per truss per panel for channel spans

Live Load, 3,000 lbs. per ft. preceded by two Consolidation engines, weighing 16,000 lbs. on truck, 96,000 lbs. on drivers, 84,800 lbs. on tender.

The posts are considered full length, the middle pins having 1 in. play in hole. Wind strains were computed at 30 lbs. per sq. ft. when train is on (the pressure against train taken as moving) or 50 lbs. per sq. ft. against superstructure only without train. The general arrangement of lateral systems was:

The *Top Lateral System* of the *Channel Spans* is continuous over three supports *T*, *G* and *T*, having cantilevers extending over *T* to *Q*. The supports *T* and *G* are relieved through transverse struts and bracing. The thrust at *T* is carried down to the bottom lateral system through deep struts and posts.

The *Bottom Lateral System* of the *Flanking Spans* and *Bottom Lateral System proper* of *Channel Spans* are continuous over five supports *a*, *p*, *g*, *p* and *a*.

The horizontal *Intermediate Lateral Systems* over curved sections of *Channel Spans* take up one half of the moving wind pressure; the other half is carried over by vibration rods to the bottom lateral system.

The intermediate lateral system is relieved through end vibration rods at *P* and *G*.

The wind pressure on *Flanking Span* is divided by vibration rods in proportion of 2 to 1 between *upper* and *lower laterals*.

Tipping Displacement Strains; freight train 10 ft. high at 30 lbs. per sq. ft. with center of pressure 8 ft above rail.

The equalizing links at the top of the center post between the two channel spans were fixed in the direction of a mean of the two strains obtained in each of members *c'G'* and *f'G'* with second driver over *c'* and over *f'* respectively. These strains were obtained correctly, before direction of link was known, by working back from a neutral point in the spans: (where shearing force is zero). The horizontal links between lower pins of equalizing links hold these links in their required directions and prevent ambiguity in the value of all strains calculated thereafter.

The deflections due to elasticity of iron and pin play are taken out by shortening top chord members *O P* and *F' G'*, and by lengthening the bottom chord members *p q* and *f' g'*.

A camber is given to the straight section of channel spans, and besides, point *w* is raised by shortening top chord members *R S* and *D' E'*.

All rivets are steel ⅞", and spaced 3 in. c to c in all tie plates, connections and at ends of all members. All end rollers are covered in with casings and aprons.

The total weight of steel and iron in the structure, as originally estimated and as actually turned out from the shop stood as follows:

	Orig. Est. Weights.	*Actual Shop Weights.*
3- 80-ft. spans,	211,000 lbs.	212,000 lbs.
8- 240 "	3,864,000 "	3,863,504 "
2-269 "	1,428,000 "	1,406.190 "
2-408 "	2,743,300 "	(Not finished.)
1-235 "	511,000 "	409,300 lbs.*

*Engine, shed and casings to be added.

We described more than a year ago the main details of the piers and foundations of the bridge, but they will bear repetition. The foundations are rock in a current of 8 to 12 miles per hour, the water being 90 ft. deep at the deepest point. The contract was let Nov. 1, 1885, to be finished within 13 months, under a penalty of $40,000, which was done with 18 days to spare. Messrs. REID & FLEMING were the contractors, and their work did them the highest credit. The total measurement was something over 4,000 cu. yds. of concrete, and 7,000 cu. yds. of masonry, the quantities being vastly smaller than in the Victoria bridge, a few miles below, both in the aggregate and per pier. Other comparative details of the Lachine and Victoria bridge, are:

	Lachine	Victoria
Total length, ft.	3,535	6,592
No. piers in water	12	24
Velocity of current	8 to 12 m.	2 to 8 m.
Greatest depth of water	20 to 90 ft.	22 ft.
Cost complete (about)	$1,250,000	$7,000,000
Time of building piers	1 year	6 years
Maximum span	408 ft.	330 ft.
Minor spans	240 ft.	242.7 ft.
Total wt. iron in structure	3690 tons	9,000 tons.
Cu. yds. masonry in piers	11,000 c. y.	100,500 c. y.

The contrast is most notable, especially in respect to relative amounts of masonry. The natural suspicion that the Lachine piers are probably less secure is an unwarranted one. They are of ample strength, but the difference is in part due to a less exacting location—above instead of below the Lachine rapids—but chiefly to the progress of experience and engineering knowledge. The Britannia Bridge, 1,841 ft. long in all, with two spans of 460 ft. each, contained 10,365 tons of metal and cost £602,000.

The foundations of the Lachine bridge were bottomless caissons, 24 × 48 to 60 ft. inside, with a single wall of 12×12 timber, drift-bolted together and well calked, with 12×12 struts, 8 ft. apart horizontally and 4 ft. vertically. Heavy snubbing posts were built into the up-stream end, and the caisson was anchored in position and sunk with rails, it having been roughly trimmed to fit the bottom, with inside flaps of canvas. Bags of concrete were then placed around the sides by a diver, and the remainder of the concrete supplied through a box holding about 2 cu. yds. with a flap bottom. The water was then pumped out, the concrete leveled off, and the masonry started. The piers were also heavily riprapped. The concrete was very rich, Portland cement 1, sand 1, broken stone 3. The cribs in the deepest water were protected from the current by a separate "turn-water crib," 32×8 and 28 ft., which was found very efficient.

We give below the conclusion of the discussion of Mr. SCHAUB'S paper.

DISCUSSION.

Prof. BURR.—The paper of Mr. SCHAUB and the diagrams of Mr. MOORE present the consideration of a quite remarkable structure and a bold piece of engineering. The circumstances of the location certainly justified and even necessitated a type of structure which should obviate the use of false-works in the channel spans, but just what conditions compelled double intersection triangulation in which uncertainties in web stresses may reach anywhere from 10 to 25 per cent. of their values, is not clear. It is undoubtedly a simple operation to assign definite duties to each system, and compute the resulting stresses, but the latter possess largely imaginary values in many of the web members.

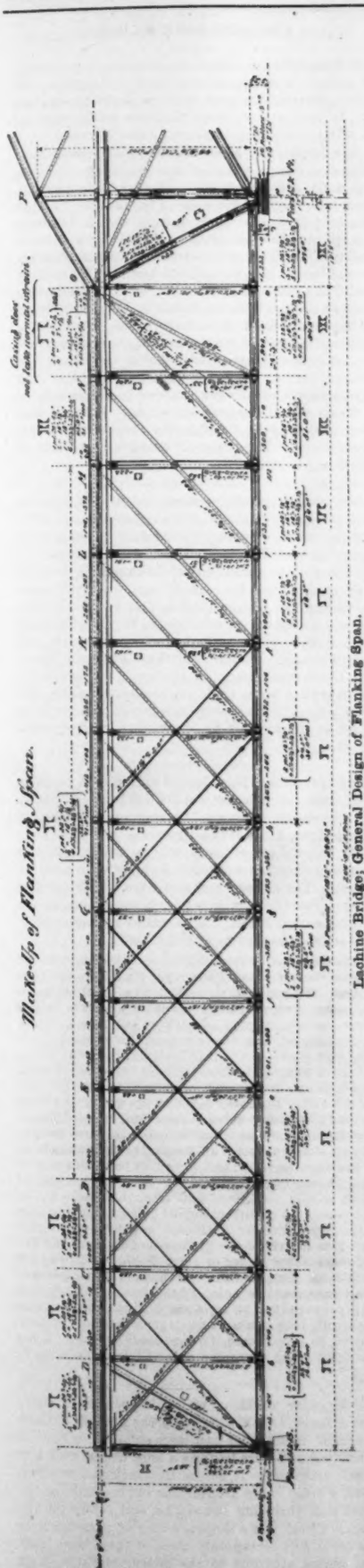
It is a well-known analytical truth, that an exact determination of stresses for such a structure is an absolute impossibility. Their real values cannot be demonstrated, and many of them may vary between comparatively wide limits. Ten years ago limited facilities in producing and handling large members, justified a loosely approximate division of stresses, with sufficiently low working stresses, but the example of a two truss 550 ft. span, designed to carry a double track railway, two roadways and two sidewalks, by American engineers, with one system of triangulation only, leaves scant reason for a double system in such a structure as the Lachine bridge.

The double system stresses are not only indeterminate in amount, but give rise to excessive metallic fatigue by the quick transitions of alternately heavy and light concentrations from one system to another.

The combination of the cantilever principle for the fixed load, with that of continuity for the moving, is open to serious objection with a simple form of truss; but where there is added the uncertainties of form already considered, together with the super-addition of positive omission in the computations, the objections do not decrease. The very approximate character of continuous stresses in fixed spans, and under conditions favorable to the truss, are too well known to require specific consideration, as indeed, Mr. SCHAUB clearly shows; in the present instance, however, some very complicating conditions were introduced in the design, and appear to have been entirely neglected in the computations.

Mr. SCHAUB gives various familiar formulæ for the moments and shears under continuous girders on the

* A large lithograph sheet giving still further details of the computation of strains, etc., etc., has been prepared by Mr. MOORE and can be obtained for a time at $2.75 each of John McKittrick 212 Locust St., St Louis, Mo.



assumptions that the co-efficient of elasticity and moment of inertia are constant, also that the supports are all on the same level, also that the girder is *straight between supports*. The latter condition, it will presently be seen, has considerable meaning. The co-efficient of elasticity, even in mild steel, will vary from 5 to 10 per cent, either way from a mean value in the same structure, and the moment of inertia ordinarily varies much more. But Mr. SCHAUB is probably correct in assuming that the consequences are not very serious, so far as these items are concerned. It is safe to assert, however, that the derangement of stresses arising from unequal settlement and simultaneous variety in temperature, which will at times exist throughout the structure, will very frequently be far beyond the reach of adjustable supports at the ends of the balancing spans.

The only effective adjustment is an absolute fixedness of stresses in a design that will not permit their variation.

There can be no doubt that the omission of the fact that the girder is not straight between supports throws a very grave element of doubt over the results of the computations for the moving load.

Prof. BURR does not agree with Mr. SCHAUB, that it is common practice among American engineers to place pins at the center points of posts in perfectly fitting pin holes, or that the practice is pernicious in the few cases in which it has been done. The movement of the pins, which he mentions has taken place in a large pin hole, such as is used in the St. Lawrence bridge, is probably due to another cause than that of the deflection of the bridge with the consequent relative movements of its parts. Eye-bar members in double lengths will never lie in a straight line, but the center pin will lie below the line joining the pins at the extremities, in consequence of the weight of the eye-bars, their heads and the pins, since the latter have no support; and they will lie further below that line, when the bridge is free from the moving load, than when it is covered by it. It is not improbable that the difference in elevation of this pin, under the two conditions of loading, would amount to nearly a quarter of an inch in the case under consideration. It is by no means improbable, therefore, that the larger part, perhaps the entire movement which he mentions, is due to this cause.

The almost indefinitely small movement of the center of the column, in the case of the closely fitting pin, would affect the column alignment much less than the incidental results constantly occurring in the shop, in the very best of work, and the resulting derangement of stress in the column is probably too small to be worthy of any serious consideration.

One point in connection with this work is of the highest importance at this period of transition from iron to steel in structural work; and the course of the designers of this bridge is a wise one in selecting a very mild grade of steel wherever that metal was employed. The almost universal practice of using steel of 70,000 lbs. ultimate tensile resistance for eye-bars, and 80,000 lbs. ultimate resistance for the steel in columns, is as yet open to some criticism. The working stresses in these high steels are taken at a value proportionate to their ultimate resistance. While this ought to be a safe rule to follow, if our experience were sufficiently extensive to confidently control the effects of shop processes and manipulations in the production of finished members, bridge members of these high grades of metal, free from internal conditions of stress, which in some cases militate very seriously against their ultimate resistances, cannot yet be produced. It is far wiser and better engineering, therefore, to use mild steel with corresponding values for working stresses, as was done in the case under consideration.

Tensile steel with an ultimate resistance, of 62,000 lbs. per sq. in., and compression steel running from 65,000 to 70,000 sq. in. in ultimate tensile resistance, will give finished bridge members of a thoroughly reliable character, and it is in all probability much safer to use higher working stresses with such metal than with the higher grades of steel, which have been very generally used.

It is a matter of congratulation, therefore, to the engineers of this structure, that they have selected a material which can be confidently relied upon in the performance of its duties.

Mr. SCHAUB.—Mr. BUTLER'S suggestion to make the long diagonals in one length is generally carried out where the lengths do not exceed 45 ft. In this country it is more convenient to use shorter lengths, say 35 ft. In general, all lengths in the Lachine bridge had to be confined to about 40 ft., which necessitated splicing all members above that length. In the 520 ft. span of the Ohio River bridge, at Cincinnati, it was specified that the long diagonals should not be coupled by a pin through the post, and here the coupling was made by a pin a short distance away from the post, obviating all the objections to making the long diagonals in two lengths.

The use of LAUNHARDT formulæ, as Mr. BUTLER suggests, being well adapted for the continuous spans in the Lachine Bridge, is very questionable.

The LAUNHARDT formulæ are based on a few experiments made by WÖHLER on small specimens in tension only; from which LAUNHARDT and WEYRAUCH deduced the formulæ for working stresses acting in opposite directions. The formulæ are, as used by Mr. JOSEPH M. WILSON, M. Am. Soc. C. E., Consulting Engineer P. R. R.:—

For pieces subject to compression only or tension only,

$$(1)\quad a = u\left(1 + \frac{\text{minimum stress in member}}{\text{maximum} \quad " \quad " \quad "}\right)$$

For pieces subject to stresses acting in opposite direction,

$$(2)\quad a = u\left(1 - \frac{\text{maximum stress of lesser kind}}{2 \times \text{max. stress of greater kind}}\right)$$

in which

a = permissible stress per square inch, either tension compression.

u = for doubled-rolled iron in tension per square inch 7,500 lbs.

u = for rolled iron in compression, 6,500 lbs.

The LAUNHARDT formula as used by the Union Bridge Co., for the Kentucky and Indiana Bridge over the Ohio River at Louisville, is:—

For pieces subject to stresses acting in either one or opposite directions,

$$a = u\left(1 + \frac{\text{minimum stress in member}}{2 \times \text{maximum stress in member}}\right)$$

which is identically the same as formula (2) given by Mr. WILSON, the minimum stress in any member becoming the maximum stress of the lesser kind when the minimum stress is negative and the maximum tress positive. The use of the formula as given here, inasmuch as some tensile members in steel are allowed to be strained above 18,000 lbs. per sq. in. for a working stress, is questionable. The experiments of WÖHLER should be extended to members subject to stresses in opposite directions before any formulæ which so materially affect the unit stresses are employed.

In comparing the weight of one of the 408 ft. channel spans of the St. Lawrence to the 400 ft. span of the Plattsmouth bridge, it might be said that the former will weigh fully 400,000 lbs. more than the latter.

Mr. BOUSCAREN'S statement with regard to the fixing of the points of contra-flexure in the shore arms of the Kentucky River bridge, to preclude a reversion of strain, is only correct after the bridge was swung complete. During the erection a reversion of strain must occur in the shore arms, and was provided for in the Kentucky River bridge by adding sufficient section in the chords to allow the erection to proceed as a cantilever. It is easy to see that a large percentage of the metal in the chords near the points of contra flexure of the Kentucky River bridge had to be introduced, which was not required after the bridge was completed. This fact is what led Mr. SMITH to fix the point of contra-flexure where the use of extra metal for erection as a cantilever would be avoided, as he did in the Minnehaha cantilever in 1881.

The maximum strain per square inch is developed in the cantilever arms next to the flanking (balancing) spans; and occurs in the curved portion of the top chord in the second panel from the pier. Here the stress amounts to 20,900 lbs. per sq. in. when the cantilever is built out, with the traveling and hoisting engine standing at the end of the arm.

The maximum unbalanced load which the arms from the center pier may safely bear during erection, and before any connection with adjacent arms is made, depends solely on the width of the base which is used for erecting that portion over the center pier. There is nothing in the construction of the trusses themselves to give any base whatever; thus nothing else remains but either to use one or two temporary cribs, so as to give the necessary base, or to employ false-work immediately next to the pier on both sides in line of the bridge. The latter method is the one which has been finally adopted by the Dominion Bridge Co. It might here be said that it was Mr. SMITH'S intention to use one or two cribs in line of the bridge to assist in balancing that portion over the center pier, until the final coupling was made.

In regard to Mr. DAWSON'S statement in referring to the formulæ used for calculating the stresses in the continuous girders it might be said that, there is no possible objection to using these formulæ as long as they are known to be correct. They are derived directly from the "Theorem of Three Moments," and they certainly simplify the work very much, when using concentrated loads. Mr. DAWSON'S distinction between continuous girders and cantilever bridges is too sharp. A cantilever bridge, such as the Niagara, is simply a continuous girder, with fixed points of contra-flexure. The cantilever principle is simply a step forward in the science of engineering, from the continuous girder. Mr. DAWSON'S objection to using pin connected trusses for continuous girders, owing to their unsatisfactory condition for expansions due to temperature, would not hold if expansion rollers are provided where

needed, and if also provision is made for the strains produced by the friction of the rollers themselves. These same provisions would have to be made in any form of girder, whether riveted or pin connected. Mr. DAWSON calls attention to the rapid variation of the depth of the trusses of the swing over the Lachine Canal, as to its effect in the calculation of the strains, inasmuch as *I*, the moment of inertia, is assumed as constant. He also cites the fact that the 396 ft., draw span of the Sault St. Marie bridge with its top chord at an inclination of 1 in 12, gave no appreciable evidence of an error in assuming *I* the moment of inertia of the cross section to be constant, inasmuch as the diagram of forces closed.

The fact that the diagram of internal forces closes does not prove the assumptions made in regard to the "Theorem of Three Moments" to be correct. In fact, any external forces whatever may be assumed to be acting, and as long as they balance, they may be applied to a structure of any form, and a diagram of internal forces which also balance may be obtained.

The assumption that *I* is constant involves an error in obtaining the reactions only, which is entirely on the safe side, as previously stated; but no amount of inclination in the chords of the draw span would prevent the diagram of internal forces from closing as long as the external forces are balanced.

The method used for annealing the steel bars for the St. Lawrence bridge is the same practically as used by all manufacturers in the States, namely, heating the bars to a low cherry red in a gas furnace, the flame not striking the bars. The temperature is not a high one, as the bars take, perhaps, a whole day to become properly heated, when they are drawn out on a sand bed, and allowed to cool under the sand. The results obtained by the Edge Moor Iron Company, show that the bars may be allowed to cool without being covered, but it would certainly be preferable to allow them to cool in sand or some similar material. The effect of annealing is to restore the molecules to their normal conditions, and to make the metal more ductile and homogeneous. The extensive experiments made by the Edge Moor Iron Company on the steel bars for the East River bridge show that annealing reduces the ultimate strength and increases the ductility. The eye-bars used in the St. Lawrence bridge are made by the Kloman process; that is, the metal in the head is rolled thicker than the body of the bar, which leaves a lump on each end of the bar, from which the head is forged under a steam hammer.

The RANKINE formula for compression members is certainly a modification of GORDON'S formula, but the introduction of the least radius of gyration in place of the diameter is such a vast step in advance of the GORDON formula, that the RANKINE formula now stands alone.

The GORDON formula is an empirical formula, framed to suit the experiments of Mr. EATON HODGKINSON, made in connection with the building of the Conway and Britannia bridges. Now, when the GORDON formula is applied to other sections than those used by Mr. EATON HODGKINSON, the results are not correct. Why? Simply because in the GORDON formula there is no variable dependent upon the Moment of Inertia of the cross section, a very important element, when it is remembered that a long column must be designed to resist flexure as well as direct thrust.

Mr. BURR'S objection to the double intersection type of truss must also hold good for any ordinary discontinuous span. Why the web strains in this form of truss should be uncertain within limits ranging from 10 to 25 percent, Mr. BURR does not make clear. With long panels, such as those used in channel spans of the St. Lawrence bridge, quick transitions of alternately heavy and light concentrations, from one system to the other, cannot take place. To be sure, a single system would have been desirable, if other conditions could have been ignored. A single system would have required very much longer panels, which would have made the curves in the chords a series of straight lines, the effect of which would be anything but pleasing to the eye. Longer panels would have necessitated using built stringers in the place of rolled beams, an objectionable process in this country as rolled beams are very much cheaper than built beams.

Mr. BURR says:—"It is undoubtedly a simple operation to assign definite duties to each system and to compute the resulting stresses, but the latter possess largely imaginary values in any of the web members." If Mr. BURR will examine the diagrams of Mr. MOORE he will find that where the two systems do combine they are united by an equalizing link, the direction of which is fixed, not arbitrarily, but by working back from a neutral point in the span where the shearing force is zero, for a position of the load which is known to give the maximum. This operation is carried out independently for each system. A mean, which is the resultant of the maxima, fixes the direction of the equalizing links. They are held in position by proper construction, and prevent any ambiguity in the value of all the stresses calculated thereafter.

If Mr. BURR would give his formulæ more clearly, that is, the formulæ which he says should have been used for calculating the moments and shearing forces for the continuous girders in the St. Lawrence bridge, it might be possible to make a comparison, with a view to determine exactly how much error is involved in assuming the beam to be straight between supports. If there are any formulæ that are more accurate, and at the same time as practical as those that were used, it would be of interest to know them. There is no structure in existence in which the formulæ Mr. BURR gives have ever been employed.

It has been shown with sufficient clearness that distortions must take place in the members themselves, in a structure where the diagonals are held by a pin to the post at the center. It is a matter of simple computation to determine exactly where the diagonals cross the post when the truss is cambered. In the 240 ft. deck spans, the point of intersection of the diagonals with the post is exactly ¼ in. below the middle of post when the truss is cambered. The diagonals do sag where they are free to sag, but this is altogether another consideration. The practice of fixing the diagonals to the posts, at their middle, is comparatively a new one, but it is only necessary to look among the more recent structures, built in the United States, to establish its popularity.

Railroads as Civilizers.

The New York *Times* has recently made the following very just comments which our forthcoming map of railroad construction in the Southern States will more than support. If all that is needed to cook the raw material of the South is a railroad gridiron, the indication are good that there will be plenty of gridiron.

"The construction of thousands of miles of railroad in Eastern Kentucky and Tennessee, for which surveys have been made and financial support has been obtained, will cause great mineral deposits to be utilized and at the same time gradually civilize a region thus far given over to outlaws of the Tolliver type. The ENGINEERING NEWS recently published a map showing the railroads which were in use in the United States at the end of the calendar year 1885, and the roads made in the year 1886. A glance at this map shows that the new lines were for the most part built in the region lying between the ninety-fifth and one hundedth meridians, where the closely woven network of roads covering the region north of the Ohio river has been extended in Kansas, Nebraska, and Dakota. It also shows a broad belt almost devoid of railroads lying between Western Pennsylvania and Northern Georgia. Parts of this district can never support a dense population, and the mountain ranges in it preclude the construction of such a railway cobweb as exists in the region between Pittsburg and Topeka; but nevertheless the roads on the slopes and plateaus and through the gaps are to be multiplied in the next ten years. Our dispatches from Knoxville contained a few weeks ago a list of projected roads in Eastern Tennessee and adjoining districts either under survey or under contract embracing more than 3,000 miles of track. Important extensions have been planned or are already in process of construction in Eastern Kentucky. The timber and the mineral treasures of the mountain region have attracted the capital which is to be expended in this work, and the cities are freely contributing their money for the support of the companies.

"By no means the least important result of the building of roads in this neglected region will be the enlightenment of its inhabitants. There are at least fifty counties of Kentucky and Tennessee that are not reached by railroads or telegraph wires. The new roads will serve as missionaries to transform gradually but surely the character of the secluded villages, and put an end to the feuds and vendettas in which the energies of the isolated people have been expended. Their little world on the highlands and mountain slopes will soon learn something about the great world that surrounds it, and the Tollivers and Johnsons and Turners will find their occupation gone. A new population, brought in by the industries which the railroads will develop and serve, will subdue and change the old. A similar change will eventually be wrought in Southern Missouri, where such lawless organizations as the Bald Knobbers have ruled. These maps and the current news reports show that there is in the country a great deal of very raw material yet to be cooked on the railroad gridiron."

Herapath's, of Sept. 24, says that the Chilian Government has withdrawn its opposition to the proposed contract made in the interests of the Peruvian bond holders, in which the Messrs. GRACE of this city are interested. Popular Chilian clamor was at first against it, but an explanation by Messrs. ARANIBAR, TYLER and GRACE removed the erroneous impressions existing.

ENGINEERING NEWS.

THE first of what will no doubt prove to be a series of car stove disasters has already happened, at Kouts, on the Chicago & Atlantic Railroad, on Oct. 11. It was one of those disasters which seem to have no redeeming feature, since it could only happen from the most discreditable looseness of discipline. A fast express was two hours late from a partially disabled engine. It passed a fast freight three miles back of the scene of the disaster, and the freight followed so close upon it that in less than one minute after an unexpected stop a tail collision took place. There was not even an attempt made to send back a flag, but if there had been it probably would not have been effective with the following train so close. Reliance is said to have been placed instead on a fixed semaphore signal, some 200 ft. back of the tank at which the stop was made; but the signal was either disregarded or the engine had already passed. However this may be, three cars were almost immediately wrapped in flames, a stove in the sleeper at the rear having been smashed, and most of the deaths and injuries resulted from this cause alone. There appear to have been some 15 killed and 10 injured.

THE extent to which economy as well as safety has been sacrificed by many of the railroad grade crossings in use is curiously illustrated by the alleged fact (which we believe is substantially correct) that the lowering the grade on the Indianapolis, Decatur & Springfield road for some distance in order to cross the Chicago & Indiana Coal road below the latter's grade, is proving so valuable an improvement for the I. D. & S. company that their engines will haul four more cars over the road than they could before this, the steepest grade on the road, was cut down. There are not many such extreme cases as this, but there are very many where one or two cars could be added to the train if the crossing stops were eliminated.

THE New York, New Haven & Hartford is doing itself honor by its efforts to abolish grade crossings. It appears that there are 518 crossings on its line in Connecticut, alone The prospects are that some 20 or 30 of these at least will be taken out this year, and that the work will go on with increasing impetus. The citizens in many cases, with a common short sightedness, rather prefer gates, and to one such dissenter Prest. CLARK made such an admirable answer that we reprint it in full:

"The objection to the use of gates is that they do not answer the purpose. Time after time this has been proved. We cannot hire perfect men to attend gates any more than we can hire perfect servants in our houses, or perfect men to work on our farms. Using the best discretion at our command in the selection, the gate-man sometimes fails in his duty. Any one of you who have occasion to drive through the country, upon approaching a crossing where gates are erected, on seeing the end of the gates pointing up, would take it for granted that the crossing is clear for your use, forgetting that the gate-man may be asleep, or have stepped into his shanty to warm his fingers, or be unmindful of an approaching train; and so you, or your wife or your children, *are lured* into danger. With the increase of trains on this road,—and year after year there will be still more—the inconvenience of being obliged to stop at the gates is to be considered and the only radical cure is to get rid of the grade-crossings, carrying the highways either under or over. Besides this, you get by so doing, benefits from the changes which perhaps you do not think of now. I have been sitting in this room for about half an hour, and during that time there has hardly been a minute when there was not a whistle blowing to warn people of an approaching train. When the grades are separated you will have no more of that."

A singular accident which happened in Gloucester, Mass., Oct. 8, illustrates the wisdom of these remarks. Some workmen were engaged in moving a building and were hauling a long chain, with two horses attached to it, across the track at a crossing, when a train came around the curve, striking the chain and throwing the engine and tender off the track. There was a large number of passengers on the train, but fortunately none of them were hurt. The horses attached to the chain, however, were dragged along the track and badly injured, and a foreman seriously hurt. At the crossings where the accident happened there is a danger signal, and a

flagman is stationed there, but it appeared that neither was the signal shown nor did the flagman give them any warning of the approaching train.

THE Nicaragua Canal Association, of which Mr. H. C. TAYLOR is General Manager, is preparing to send several parties of engineers to Nicaragua next month.

Mr. C. H. BLAKE, civil and sanitary engineer of Irapuato, Mexico, writes us that the East Indian water-lifts, illustrated in our issue of Sept. 10, are essentially the same as those in use in Mexico to-day.

ELECTRIC railways are being used in mines in Germany, near Dresden, at Beuthen in Upper Silesia and at Neu-Stassfurt, under the system of SIEMENS and HALSKE, of Berlin. The first experiments were made in 1882. The conductor in the mines is formed of two rails of T-iron bolted to insulators fastened to the roof, the collector is a carriage running on these T's. The generating dynamo makes 750 to 850 revolutions per minute, and is driven by a 15 H. P. steam engine. The trains consist of from 10 to 15 cars weighing 5 cwt. each, and carrying 10 cwt. of coal each. The speed is 6 miles per hour. In two shifts of 8 hours the plant will remove about 380 tons of coal. The whole cost, including steam engine, conductors, locomotive and erection, was $4,050. As compared with other power it stands per ton-mile as follows:—electrical traction 4 cts.; horse traction, 5 cts., and traction by men, 9 cts.

Mr. FRED D. OWEN gives in the Providence *Journal* a full description of a "towing tank" on the Clyde for testing models of vessels, which perhaps had something to do with the *Thistle's* model. The models are made of paraffine, and the scheme is said to possess great advantages.

The plant is about 350 ft. long by 20 ft. in breadth. The tank proper is 300 ft. long by 20 in breadth, and 6 ft. depth of water; the sides are of masonry, with cemented walls and bottom. The roof which covers the whole, is a very low form of the A pattern, with numerous skylights. From the roof is supported by means of hangers the footpath of some 3 ft. on each side of the way, which is about 4 ft. in width by 300 ft. long, and one foot from the water. Upon this hanging path is supported a track and the traveling frame or carriage, which carries the guiding arm and register mechanism. This traveling returning frame, which is drawn by steam power, carries the operator and a delicately placed lever arm that directs and drives the model, which floats on the mirror-like surface of the water below, and connects with the electrical mechanism on the carriage, which registers by a pencil on a cylinder carrying a piece of ruled paper driven by clock work, the resistance of the model. The whole frame mechanism, operator and model, when adjusted, is then drawn along at a certain rate of speed by steam power from a stationary engine at the end of the building by means of a wire cable, at a speed proportionate to the scale of the model. All the resistances are recorded upon the paper diagram by an automatic electrical device.

The Greenville, Miss., Submerged Dikes.

Greenville, Miss., has been greatly troubled by the caving of the river front and in the last ten years about 1200 ft. in width of available property has been swallowed up by the greedy Mississippi. The failure to include any appropriation for the work in the River and Harbor Bill of this year left the citizens in a bad predicament, and so to the $37,500 available of the last appropriation the town has added $50,000 raised by bonds and has gone to work upon the improvement. Under the advice of Major WM. STARLING, engineer of the Levee Board, Capt. ARTHUR SLIDER was instructed to proceed with the work, and Mr. C. H. WILSON is the engineer in charge.

The plan adopted is known as the "submerged dike" system. It was used with absolute success last year at Memphis, where five dikes were constructed at a cost of less than $50,000. Here the work will be on a larger and more expensive scale. The dike system has also been employed at Gouldsboro, opposite New Orleans. The base of each of these dikes consists of a stout mat woven over and under with willow branches, which are supplied by contractors from the Arkansas side. The work is of an interesting character, and will eventually give employment to over 400 hands. The weaving process is carried on on a floating structure known as a "mattress way," an inclined plane toward the water. As each section of the mat is completed and securely bound with iron rods and stout galvanized wire it slides into the river and the work proceeds. These Greenville mats will vary in size. Some of them when completed will present the appearance of huge woven rafts, 400 ft. by 200 ft. These are afterward sunk by loads of stones to form the substructure of the dikes. Cribs, also loaded with stones, will be placed on these mats, thus forming a complete dike. These dikes will project from the river bank at intervals sufficiently close to prevent any scouring out, and rather to encourage filling in.

Experiments on the Poetsch Method of Shaft-Sinking by Freezing.

M. ALBY in the *Annales des Mines*, Vol. XI. p. 56, gives the results of some experiments on the above subject specially directed towards testing the formation of ice around the refrigerating tubes, and the resistance of the frozen ground.

The apparatus used consisted of a sheet-iron cylinder filled with wet sand; this cylinder was 10 ft. long and 4 ft. 7 in. diameter, standing in a pit 1 ft. 8 in. deep, with the surface above the ground protected by straw-rope. The freezing tube was wrought-iron $\frac{1}{16}$ in. thick, and 6¾ in. diameter, and was supported by a tripod below, and stays above. An inner tube conveyed the freezing mixture which returned in the annular space about it. The main cylinder was pierced with a double series of holes, 10 in number, arranged helically and stopped with wooden plugs. This was to permit samples to be taken from the material experimented upon at various points. Twelve small brass tubes closed at the lower end and filled with a non-freezing liquid were used in ascertaining the temperature at any distance from the central freezing tube by means of minimum thermometers attached to copper rods.

At the commencement of the experiments a layer of water 1½ in. deep was maintained on the surface of the soil, a slight leakage being permitted past the plugs in the main cylinder. As the freezing proceeded the leakage ceased, and the water layer was absorbed while that part of the sand not frozen was apparently drained of its water and showed fissures. When the mass was allowed to thaw the leakage recommenced, and after some days the layer of water reappeared. This would appear to be caused by the forcing apart of the grains of sand during the freezing of the water, to the extent perhaps of 7 per cent.

The general results of the experiments as stated by the author are as follows:

(1). Although the temperature of the freezing mixture varies considerably at different parts of the central tube, that of the frozen earth at correspond ing positions is nearly regular and the freezing is practically constant throughout.

(2). The general form of the frozen mass is barrel-shaped and fairly regular in outline.

(3). The calorific effect of the surrounding ground is very noticeable; the lower part of the frozen mass assumes a pointed form and is the last to freeze and the first to thaw. Thawing is perceptible in it within 24 hours of the stopping of the freezing machine, while in other parts the thickness of the frozen mass continues to increase.

(4). During the thawing the temperature of the whole mass rapidly approximates zero (centigrade) and the mass thickens.

(5). In practice the freezing-tubes are from 3 to 5 ft. apart, and while the exterior of the polygon formed is surrounded by the general mass of earth, the interior is cut off and is in the condition of the straw-jacketed part of the experimental apparatus

(6). The useful effect of the freezing-tube diminishes as the ice layer increases in thickness.

(7). The lower the temperature of the freezing mixture the better the results obtained. But in practice it is difficult to employ a lower temperature than—25° C, or —13° Fahr.

The experiments upon the resistance of the frozen ground, as found by submitting frozen cubes to compression and briquettes to tension, gave lower results than would be obtained from actual practice, as the resistance increases with lower temperature, and it was impossible to keep the specimen at its original temperature during test.

Pure ice yielded to a pressure of 285 lbs. per sq. in. under repeated tests, and the same value may be assigned to saturated sand. With two-thirds, or one-third the quantity of water, the resistance is proportionately reduced. Sand only slightly moist gives better results when mixed with clay.

In tension the water plays an important part. Saturated sand at a temperature of—12° C (10.4° F.) yielded to 570 lbs. per sq. in., and if the water is not in excess 427 lbs. per sq. in. can be safely depended upon. With two-thirds the proportion of water, 350 lbs. per sq. in. was the resistance; and with one-third it was almost nothing.

The Growth of City Traffic.

We present herewith three diagrams (with two more to follow) which, rightly looked at, tell a story for which we must almost go to the Arabian Nights for a parallel. We are accustomed to think of 1860 as a tolerably civilized and advanced period. That there has been growth since that date is well understood, but that there has been a growth so vast that 1860 may be looked on almost as the beginning of civilization as respects internal city traffic, and all before that almost as a period of barbarism is hardly realized.

This fact, however, is brought out in the most striking way by the diagrams which we publish, showing the internal passenger movement of New York, Brooklyn and London, and if we were to prepare similar diagrams for all the cities of the civilized world, the result would be the same. It will be seen that even in the case of Brooklyn, whose population has grown much more rapidly than that of either of the other two, the change in population has not been of a very radical nature, but the change in the amount of internal passenger traffic has been simply phenomenal. The tables we publish below, show this numerically, but the diagrams bring the same fact before the eye in what will be to most people a more convincing and striking form. It is plain that we may almost say that "before the wah" there was no such thing as city traffic in the modern sense. It has all sprung up since, and almost from nothing.

Intramural traffic, and the various facilities therefor, it follows naturally from the preceding, are daily becoming a larger and larger fraction of the work of civil engineers, and hence it behooves all of them to form some clear idea of its nature and law of growth, as an aid for wisely planning works to aid its further growth. No man can understand its law of growth fully, for in any large sense it is a thing of such modern origin that there is no data for formulating a law, but reasoning from analogy and from probabilities we may be tolerably certain that the increase that has been so sudden and so enormous in the past 20 or 30 years; so far beyond what the general public has as yet any realizing sense of; is destined to continue for some time yet in the future, and perhaps in increasing ratio. Not until the advance by leaps and bounds has stopped if it ever does, and the traffic lines on such diagrams as those we publish begin to run somewhere near to parallel with the population lines, can we assume that we can form any clear idea even of the probable rate of growth, and still less of its ultimate limit.

For example, in the diagrams which we publish, the London omnibus traffic and the New York-Brooklyn ferry traffic appear to be on something like a settled basis. They have continued so uniform in the past that there is little probability of any great and decided change in the future. The London omnibus traffic has lately grown noticeably, and the Brooklyn ferry traffic has fallen off still more noticeably since the opening of the Brooklyn bridge, but the decrease in the latter has now stopped, so that by comparison with past years we can see that it is not likely to go much farther unless the conditions change again; while the recent growth in London omnibus traffic is still more readily comprehensible. It is palpably but the reflex effect of the enormous growth in other facilities for traffic, just as is the growth in New York City horse-car traffic since 1879. A great increase in the average number of trips per city inhabitant will naturally mean a certain considerable falling of crumbs to even old and out

grown methods of transit. The London omnibus traffic, therefore, may well hold its more recent rapid rate of increase for some time to come, but any considerable increase in that rate is not likely, and a falling off in *rate* of growth is much more likely.

But who can measure by these diagrams (which give all the past facts there are) the future of the London, New York or Brooklyn horse-car traffic, or of the New York elevated traffic, or, still less, the Brooklyn elevated or bridge traffic? All that we can say is that they are growing and going to grow, and the two latter enormously. Where the growth will stop is beyond the wit of man to even guess with any approach to definiteness. It is only plain (if anything in the future can be said to be plain) that the time for it to stop is not yet.

That these diagrams have an especial interest in connection with the action to be soon had (we presume) to increase the capacity of the Brooklyn bridge is evident. The existing traffic crowds the present facilities of that bridge to its utmost capacity. It is not so difficult a matter in several ways to increase the capacity of the bridge 25 or 30 or 50 per cent., but the question then is—will that suffice, even for the requirements of the near future? Is it not rather essential to provide at once for multiplying existing facilities by four or five-fold, if in anyway possible, rather than to run the certain risk of having to rip out and reconstruct all that may have been done of a temporizing nature? If anything in regard to the future can be shown with certainty from the past, this question seems to be answered in a very positive way by these diagrams even at a first glance. If they be studied with more care, and their separate indications collated, there appears to be still less room for doubt. That particular question, however, we cannot now attempt to go into.

TABLE I.

Brooklyn Horse Car Traffic.

	Brooklyn City.	Total all Lines.	Total No. of Lines.	Population.
1858	7,706	7,706	1	
1859	9,251	9,853	2	
1860	10,478	12,375	3	266,661
1861				
1862	9,986	14,168	5	
1863	11,080	16,888	6	
1864	13,733	21,331	7	
1865	16,000	21,688	6	296,378
1866	17,199	23,360	6	
1867	22,587	30,500	8	
1868	21,965	30,025	9	
1869	22,342	35,000	11	
1870	22,980	36,975	12	365,099
1871	26,143	45,176	14	
1872	29,000	53,529	16	
1873	29,500	56,766	14	
1874	29,600	59,253	15	
1875	29,000	63,122	16	
1876	29,000	63,065	16	
1877	29,000	62,796	16	
1878	30,000	63,376	12	
1879	30,000	65,537	12	
1880	32,000	69,309	13	566,689
1881	34,000	78,591	14	
1882	37,000	78,563	13	
1883	40,000	94,083	17	
1884	45,000	103,408	17	
1885	47,000	111,919	18	631,383
1886	47,400	109,985	18	
1887				745,108

The following brief table (II.) brings out very strikingly the increase by decades and also, what is one of the most curious facts in the diagrams, the very light internal traffic per inhabitant of London as compared with either Brooklyn or New York. London, in fact shows a surprisingly small aggregate as compared with any of our American cities, which at the present date are almost all above 120 trips per inhabitant, and range from that to upwards of 200. Whether this contrast is one which will be permanent, as a result of the more rapid pace of this country, or whether it is merely that London has been slow in developing its facilities, it would be hard to guess, but the London diagram shows very strikingly one curious fact which does not appear at all in the other diagrams, that the addition of new facilities has created entirely new traffic and not drawn in the least from that before existing; and this fact would seem to agree with inherent probabilities in indicating that London has so low a traffic because it has not yet as great facilities, and hence that the construction of new lines ought to be an exceedingly promising field for investment. London people may not be as restless as New York, but London is still the metropolis of the world, and there seems no reason why its internal movement should be so conspicuously smaller than in this country, except lack of facilities.

In both the New York and Brooklyn diagrams the influence of the war, and of the dull times of 1873 and 1878 in checking growth is quite notable, although all that was temporarily lost seems to have been more than regained later. The effect of the elevated lines upon horse-car traffic is very curious indeed. For the first few years it checked it greatly, but recently the street car traffic has been fully holding its own, in spite of phenomenal growth on the elevated.

The Brooklyn elevated traffic has as yet but begun. That it will ever grow to anything like the New York traffic is hardly probable, but that it will increase fast and greatly is quite certain. In a few months there will be four lines running instead of one. It may be a mere coincidence that the opening of the bridge was followed by such a marked increase in the Brooklyn horse car traffic, but that the bridge has not as yet added greatly to the New York-Brooklyn traffic is equally clear. Nearly all the bridge traffic so far has been taken solely from the ferries, and chiefly from one ferry, Fulton. The other four have fallen off but little, and the two farthest from the bridge (Atlantic and Hamilton) not at all, indicating that but a portion of Brooklyn has as yet been greatly benefited by the bridge.

The very slow rate at which the New York Brooklyn traffic has increased, in comparison with the vast internal growth of each, is conspicuously brought out both by the diagrams and the following Table, II. That it is unnaturally slow, and means simply that the cities have been growing apart for lack of better facilities to grow together, is undeniable. Whether these better facilities can be had is another question, but that Brooklyn is suffering greatly in a business way by its comparative isolation from New York does not admit of doubt.

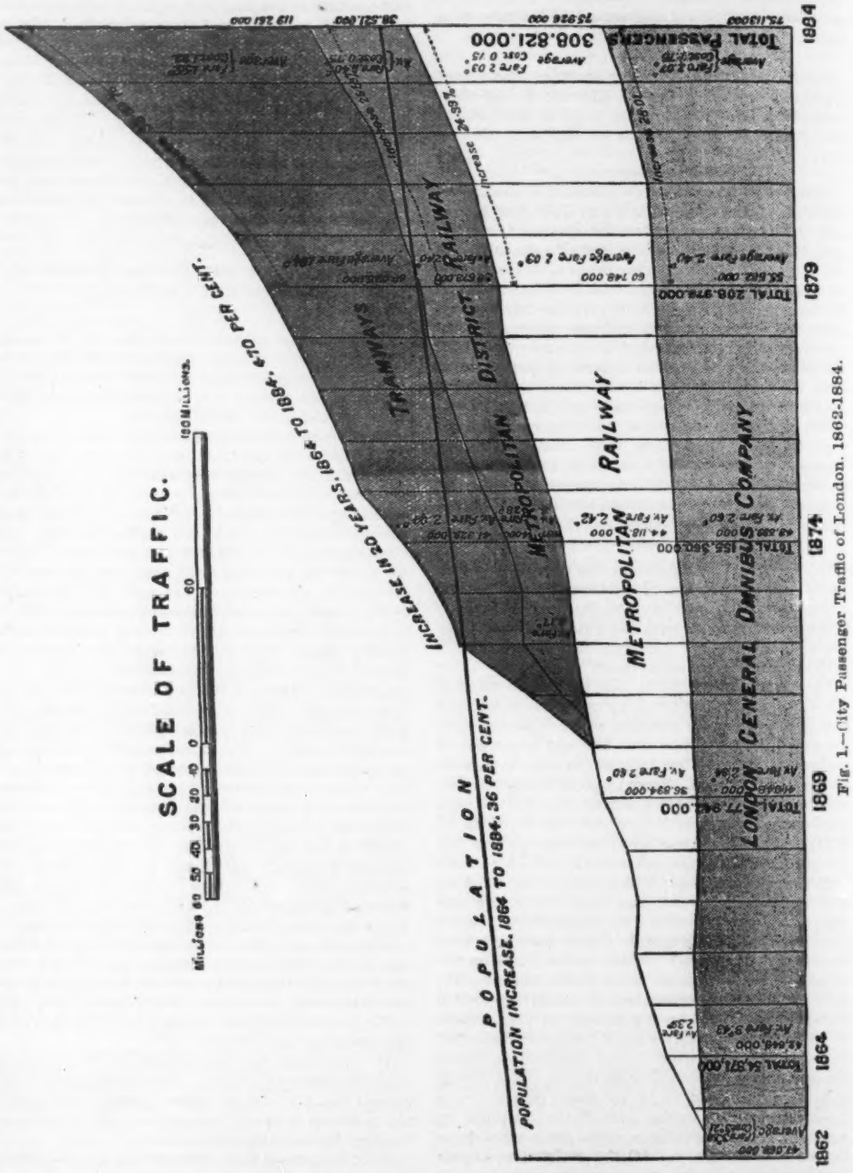


Fig. 1.—City Passenger Traffic of London. 1862-1884.

Below we give in Table II the comparative figures above referred to, and in Table I the record by years of the Brooklyn horse car traffic. The New York internal traffic was plotted from a table which appears on page 714 of the "Economic Theory of the Location of Railways."

The London diagram is copied from one prepared by Mr. J.H. GREATHEAD, M. Inst. C.E., the engineer of a proposed new underground cable line. The London *Railway News* comments as follows on the diagram:

"It will be seen that before the Metropolitan (underground) line was opened, the London General Omnibus Co. carried about 40,000,000 of passengers annually. The average fare was 7 cts., and the cost to the company 6¼ cts. per passenger. There was no marked increase in the business of the company until 1872, when, owing to the competition of railways and tramways, a reduction

in prices was made whilst a still greater expansion has taken place in the last few years, when the severity of the competition has necessitated further reductions in rates and improved vehicles. The average fares by omnibus are now practically the same as by the railway—viz., about 4 cts. It will be seen that the London General Omnibus Company now carries very nearly as many passengers as the Metropolitan Railway—viz., about 75,000,000 each. In regard to cost, however there is a great differences, the expense per passenger by omnibus being about 3½ cts., whilst by the railway the average is only 1½ cts., although the latter spends $120,000 a year upon its road, and contributes $160,000 to the local rates, whilst the omnibus is free from both these charges. In spite of the higher cost per passenger, the omnibus is, however, able to pay 12½ per cent. to its shareholders, whilst, owing to the enormous cost of the road, the railway company barely obtains a 5 per cent rate. On the District Railway the growth of traffic, has, it will be seen, been at practically the same rate as on the Metropolitan system—viz., 25½ per cent. in the five years ending with 1884; but on the tramway system—where there has, of course, been a much greater increase of mileage—started at about the same time, the expansion of business is equal to about 100 per cent. On the tramways, the average fare is about 3 cts. and the cost about 2¼ cts. per passenger. Taking the total traffic of all the system—railway, omnibus, and tramway—the increase in the number of passengers carried has been about 50 per cent. in the last five years; and this seems to have been about the normal growth during the last twenty years. In the twenty years, from 1864 to to 1884, the passenger traffic of the metropolis has increased 470 per cent., while in the same period the population rose only 36 per cent. The additions to the transit facilities north of the Thames can, however, hardly be on the same extensive scale in the future, as the facilities on the main routes have now practically reached their paying maximum; but much yet remains to be done in developing the subsidiary and main tramway routes south of the Thames, and the question to be decided is what is the best method of securing that result. Ordinary underground railways are obviously out of the question—the cost of acquiring the necessary property being so enormous that only the densest traffic can possibly give any return on the outlay. Most of the main thoroughfares are already so crowded that any large addition to the omnibus service is undesirable, and tramways will never be allowed to come into the city or over the bridges. Some system securing the advantages of a tramway and underground railway, seems, under these circumstances, the best adapted for meeting the difficulties of the case. By running such an underground line beneath the public thoroughfares, and at a sufficient depth to avoid interfering with pipes and sewers, the enormous cost involved in acquiring property is avoided, and the streets are relieved to a corresponding extent."

TABLE II.

Total of Combined Internal Traffic of New York and Brooklyn; 1860—1886. in Thousands of passengers.

	1860	1870	1880	1886
New York Horse Car	36,455	115,139	150,390	210,510
" Elevated			60,232	126,778
Brooklyn Horse Car	12,375	36,975	69,209	109,985
" Elevated				10,159
New York-Brooklyn Ferries	est. 18,000	38,700	46,400	36,253
" Bridge				24,478
	66,830	190,814	326,831	518,163
Per cent. of N. Y.-Brooklyn traffic	26.8	20.3	14.5	9.8
New York Population	813,669	942,292	1,206,299	1,480,000
Brooklyn "	266,661	396,099	566,689	680,000
Total	1,080,330	1,338,391	1,772,988	2,160,000
Yearly Trips per Inhabitant.				
New York, internal	45	122	174	228
Brooklyn, "	46	93	122	177
Both together, internal	45	114	158	212
Brooklyn Bridge and Ferries	67	97	82	89
London, internal	(1802) 16	26½	58	(1884) 76

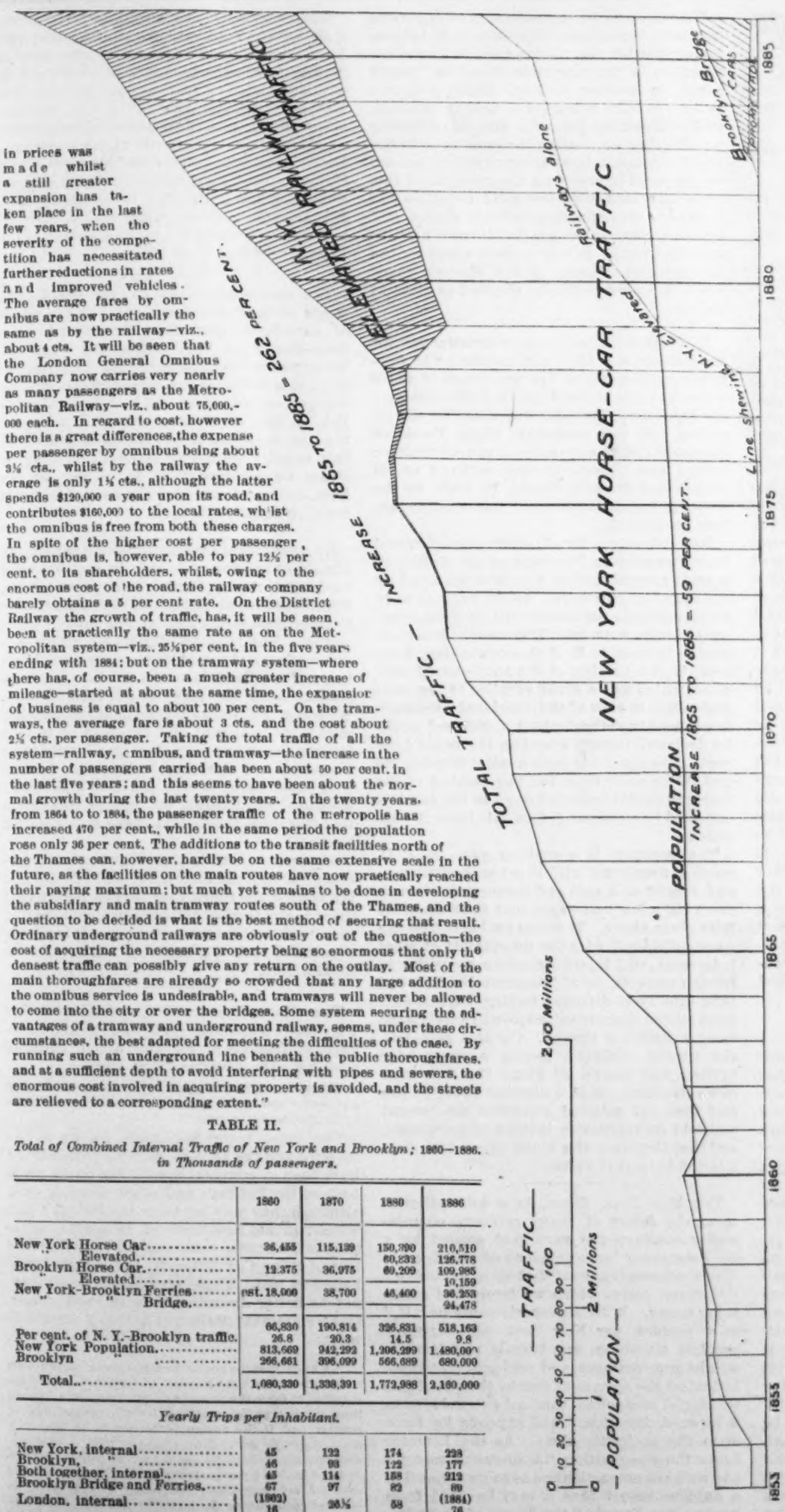


Fig. 2. City Passenger Traffic of New York, 1853-1886.

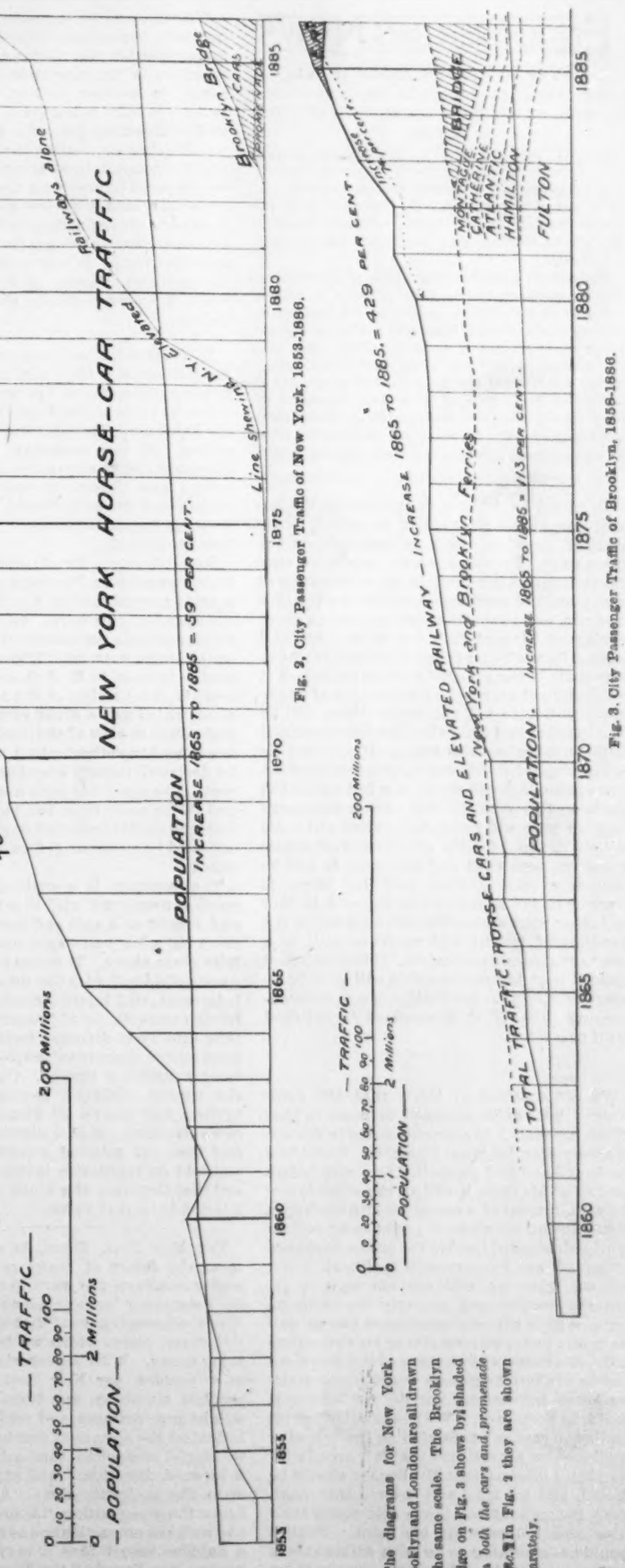


Fig. 3. City Passenger Traffic of Brooklyn, 1856-1886.

The diagrams for New York, Brooklyn and London are all drawn to the same scale. The Brooklyn bridge on Fig. 3 shows by shaded area *both the cars and promenade traffic.* In Fig. 2 they are shown separately.

ENGINEERING NEWS

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D. McN. STAUFFER, A. M. WELLINGTON, EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

Subscription. — UNITED STATES AND CANADA, $5.00 *per Year*; $2.50 *for Six Months*; $1.50 *for Three Months*; *Single Copies*, 12 *cents*. FOREIGN COUNTRIES, $6.56 *per Year*, or 3 *cents per number additional.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

IT would be difficult to exaggerate the importance of the final action in regard to the coupler question which we chronicle on our news page. It means, we are confident, very rapid progress hereafter in the substitution of a rational and mechanical coupler for the link and pin, and that will mean, not only a great saving of life and limb, but a very material change for the better in handling freight trains, especially if the change be accompanied, as it no doubt will be, by the introduction of power brakes. Trains will run faster; there will be less banging and less delay in yards; there will be much fewer break-in-twos, and from the wide range of speed which will for the first time become possible, it will result on a full half of the roads in this country that one or two more cars per train will be hauled. Then will come a loud demand for the elimination of grade-crossings, both road and railroad. It will be seen more clearly than now that there is "money in it" as well as safety; and in that and other ways a great further economy in the handling of freight will result, as well as a substantial increase of safety. It is to be hoped that all past legislative action will now be reconsidered, and the application of couplers conforming to the M. C. B. standard be required in all new work.

WE are gratified to learn that Mr. JOHN BOGART has, after repeated requests to that effect, consented to allow his name to remain in nomination for State Engineer. Should he be elected and feel compelled to resign before the end of his term, it will at the worst throw the appointment of a successor into the hands of the Governor—where it ought to be permanently—instead of leaving the choice to chance action of an irresponsible political body, but we trust he will see his way to retain the position and properly discharge its duties, which his past experience has so well fitted him to do, without giving his entire time to it. His duties as Secretary of the American Society of Civil Engineers would alone make the latter impossible, nor do we believe it would be necessary. Without desiring or intending to cast any reflection on the opposing candidate, we are satisfied that it is greatly for the public interest that Mr. BOGART should be elected, and we trust and believe that engineers throughout the State will throw their votes and influence in his favor. Politics should have nothing to do with filling such a position, especially as it is very clear to those who know the facts, that it had little to do with the nomination.

WE commend to the attention of engineers the very remarkable experiments in ballasting narrated in the "Notes upon Railway Construction in the Argentine Republic," which appear in another column. Looking upon a rich black loam as a good ballasting material, and overcoming the only alleged difficulty with it—dust—by letting the grass grow in the track, are certainly striking novelties, nor are we prepared to assert on the strength of this paper only that they are good novelties, but the proof of the pudding is in the eating, and here is apparent evidence that it made a really excellent track. It may contain a hint for the management of some of the Western roads which are very similarly situated as respects ballast.

THE past week has been an eventful one for the Baltimore & Ohio corporation. The telegraph system, which has an extent of 62,000 miles, was sold to the Western Union company for $5,000,000. The sale was made by the directors of the company while President ROBERT GARRETT was on the ocean *en route* for home; and though it was contrary to his wishes that the sale should be made to the Western Union, the transfer was legalized before his arrival.

Since his return Mr. GARRETT has submitted his resignation as President of the Baltimore & Ohio system, and it has been accepted by the Board of Directors. As we have already announced, his successor will be Vice President SAMUEL SPENCER. The event of most sorrowful interest to B. & O. stockholders, however, is the passing of the semi-annual dividend, which was a great surprise to the general public in view of the continual assurance from those in authority that a dividend would be declared, though less than the usual 4 per cent. The stock has been weak at between 120 and 130 for some time, but the passing of the dividend sent it tumbling down to 108, and it is expected to go to par before this issue is published.

The contrast is a striking one;—B. & O. stock at nearly 200, with 10 per cent. dividends, and sought as a safe and conservative investment but a few years ago; and the state of affairs given above. It seems probable that the passed dividend, with the uncertainty of what is to come, will injure American securities in foreign markets, for if "conservative B. & O," falls into such disaster, foreign buyers, who must buy on hearsay evidence, will surely have their confidence shaken. On this side, too, the passed dividend caused a great bear jubilee, and stocks all along the line went down like lead. It is a striking proof of the fact that our railroad securities are bought and sold on reputation instead of knowledge, and that the price of a stock often has little relation to its real value.

THE New York *Times*, in a late editorial upon the future of heavy artillery, complacently swallows the yarn sent abroad by a St. Petersburg correspondent of the London *Times*, concerning that "diabolical explosive"—*sleetover*, about which we lately had something to say. With a properly cautious "if," as a preface, our New York contemporary predicts aluminum gun-barrels and featherweight gun-carriages, and very generally revolutionizes the science of war by the use of this wonderful compound, that only "explodes in a forward direction," and expends its force upon the projectile alone. As the inventor keeps the composition "a profound secret," and we have no particulars as to its use, saving a dubious report that it may be fired from "paper gun-barrels," the *Times*, of necessity, perhaps, refrains from enlightening the public as to a certain-sure method of picking out this "business end" from a mass of *sleetover*. Yet, it is hardly necessary to remark, that this knowledge is very essential to the general health of the experimenter. It would not do at all, you know, if from ignorance on this important point, the gun, or the user, or some other fellow, should be propelled backwards or sideways as the result of an explosion. Doubt upon this point would decidedly limit its field of usefulness, unless the newly-charged weapon was to be supplied to the enemy only. It is amazing that such utter nonsense should be swallowed whole by two such papers as the London and New York *Times*.

THE technical report on car heating by steam in another column states as the result of experiment that about three-fourths of a horse-power per hour suffices for a car. As the ordinary locomotive rate is 30 to 35 lbs. per H. P. this indicates a condensation of 22 to 24 lbs. per car per hour. In our discussion of Feb. 19, 1887, which was almost if not quite the first to appear in any technical journal in this country defending in detail heating by steam, we assumed 30 to 50 lbs. per car per hour, and yet found that the necessary steam could be readily spared.

No mechanical advance of importance in the history of science, it is safe to say, has ever made such rapid progress in so short a time. There was then almost no one of standing ready to assert that steam heating was entirely practicable. The railroad officials were almost a unit against it; the technical press echoed them in evasive editorials which are funny enough reading after the lapse of six months only. With that half-knowledge which often makes men more arrogant and opinionated than a broader one, many "practical men" seized upon the patent fact that locomotives often had all they could do, as it was, and drew and loudly asserted the plausible but untrue conclusion that therefore they could spare no steam for heating.

At present there is almost no engineer, mechanic or railroad man in the United States so far behind the times that he will assert that there is any further difficulty in steam heating than to choose between methods. It is a truly wonderful and unparalleled change for so short a time.

THE Massachusetts Railroad Commission have made a singular error in a circular in regard to fastenings for the upper berth of sleeping cars, declaring that they:

"Know of no fastening superior to the chain, ball and socket now in use upon the sleeping cars operated by the Pullman company."

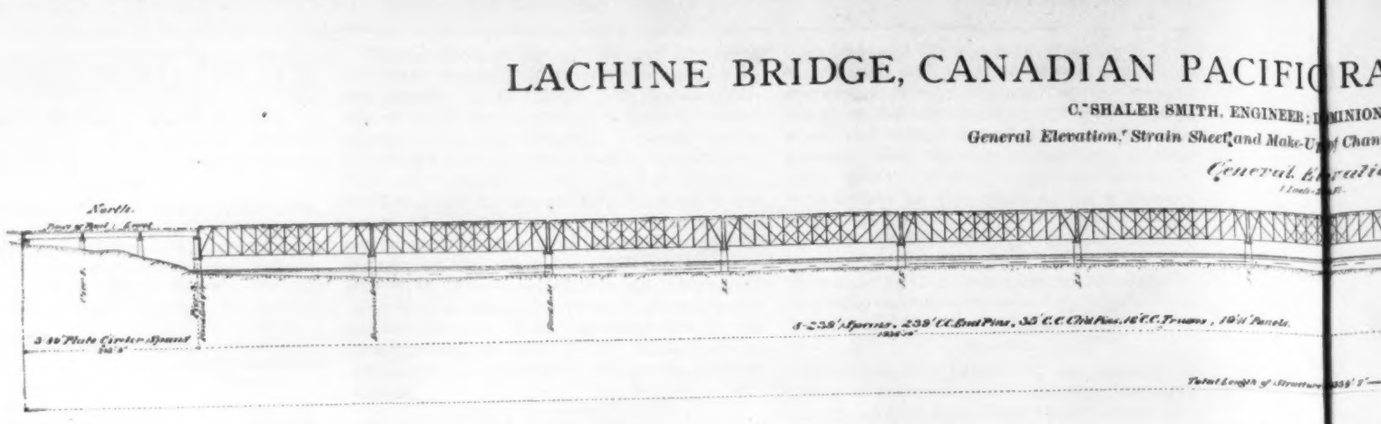
Two much better fastenings, known as the Howard and the Dayton safety berth-catches, have been in constant use for five or six years both on the Pullman and other sleeping cars, although they may not be on the Pullman cars which run into New England. Detailed illustrations of both these devices are given in Figs. 1261 1264 of "The Car Builders' Dictionary," published in 1884. Their precise character cannot be better described than in the Commission's statement (italicized below) of what they want:

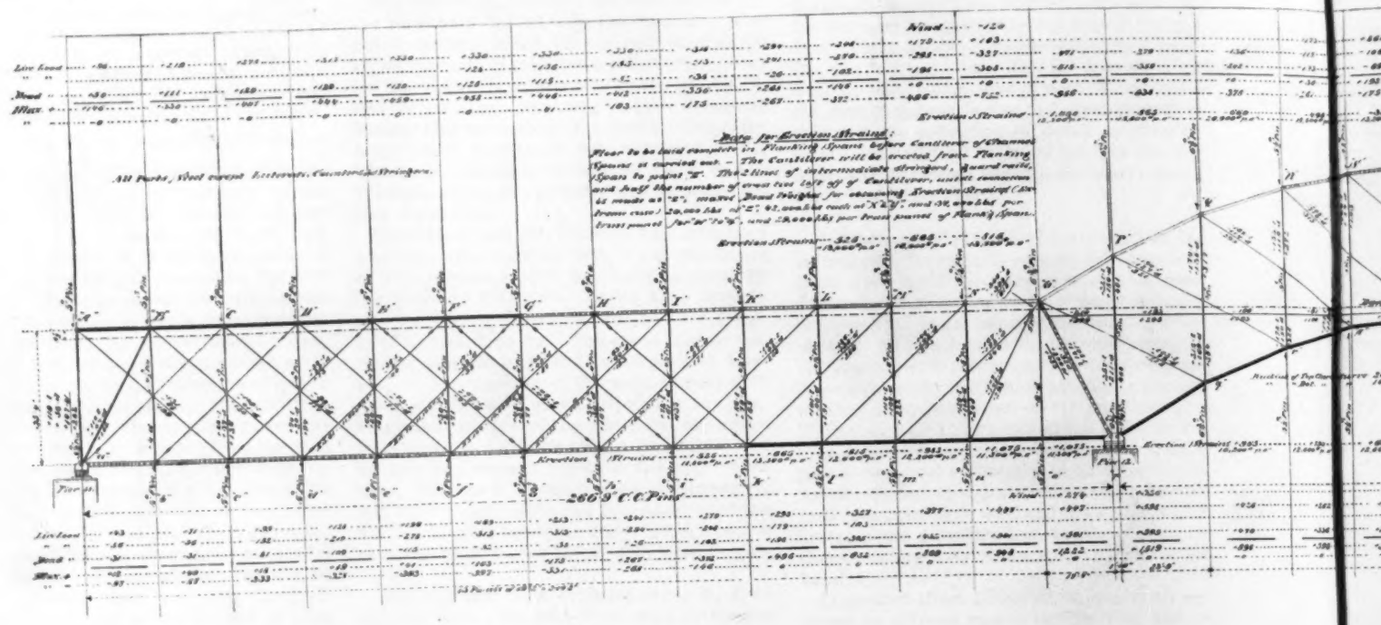
"We know that the spring lock is a great convenience to the porter, as the strength of both hands is often required to force the cover into position. But human lives are not to be sacrificed for the convenience of porters: and if the spring is longer to be tolerated, *there should be an appliance coupled with it by which, upon opening the berth for use, the spring can be "set" or fastened back in a manner to prevent its play or movement until the 'set' or appliance for locking back the spring is removed upon closing the berth for the day.* Until the spring be removed entirely or its capacity for mischief effectually destroyed, the commission must refuse the responsibility of approving any or all appliances."

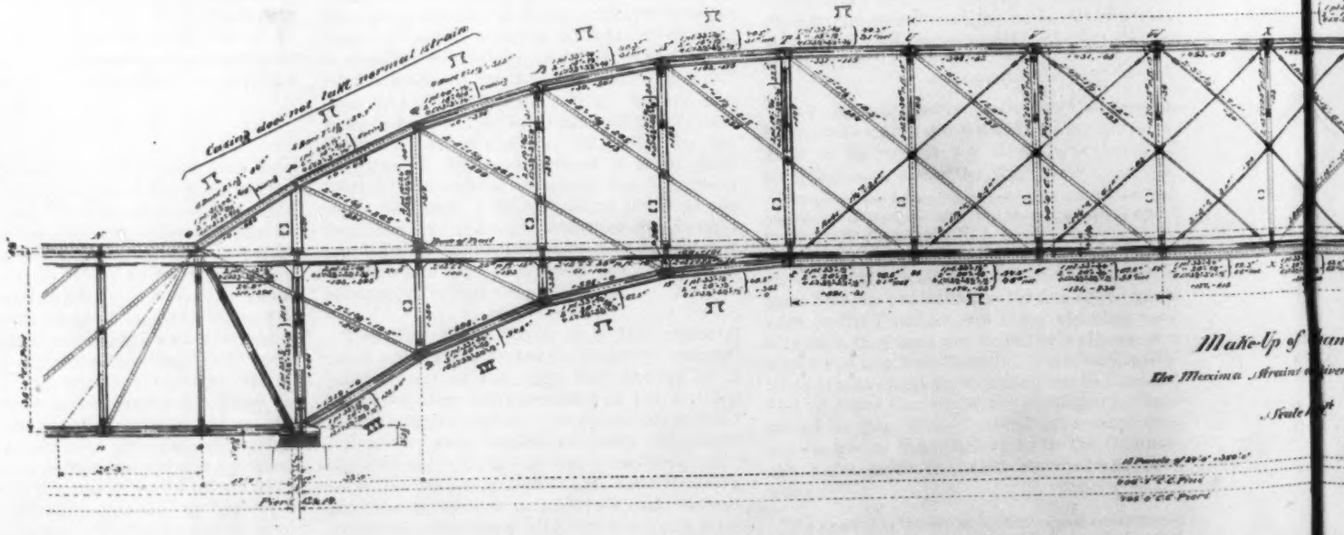
LACHINE BRIDGE, CANADIAN PACIFIC RA

C. SHALER SMITH, ENGINEER; DOMINION

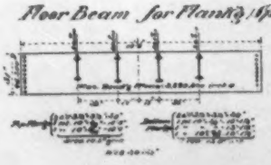
General Elevation, Strain Sheet, and Make-Up of Chan



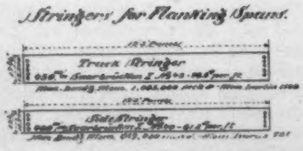

Wind
Live Load
Dead
Max.
All Parts, Web except Verticals, Counters & Stringers.
Data for Erection Strains:
Floor to be laid complete on Planking Spans before Cantilever of Channel Spans is erected and
Span to point "E". The 2 lines of intermediate stringers, guard rails,
and half the number of cross ties left off of Cantilever, until connection
is made at "E", master Road Bridge for assuming Erection Strains (Cantilever
from each 20,000 lbs at "C" 42 tons be each of N & N', and 36 tons be each per
truss panel for "D", "D", and 28,000 lbs per truss panel of Planking Span.
Erection Strains
266' 9" C.C. Pins



Floor Beam for Planking Spans.



Stringers for Planking Spans.



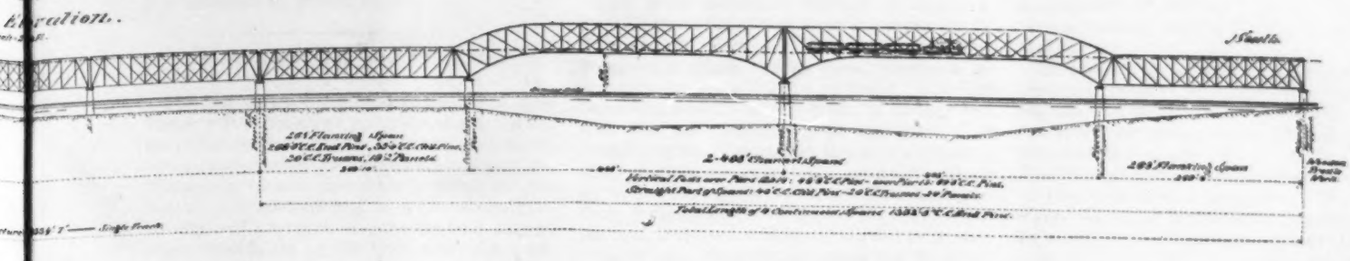
Floor Beam for Channel Spans.

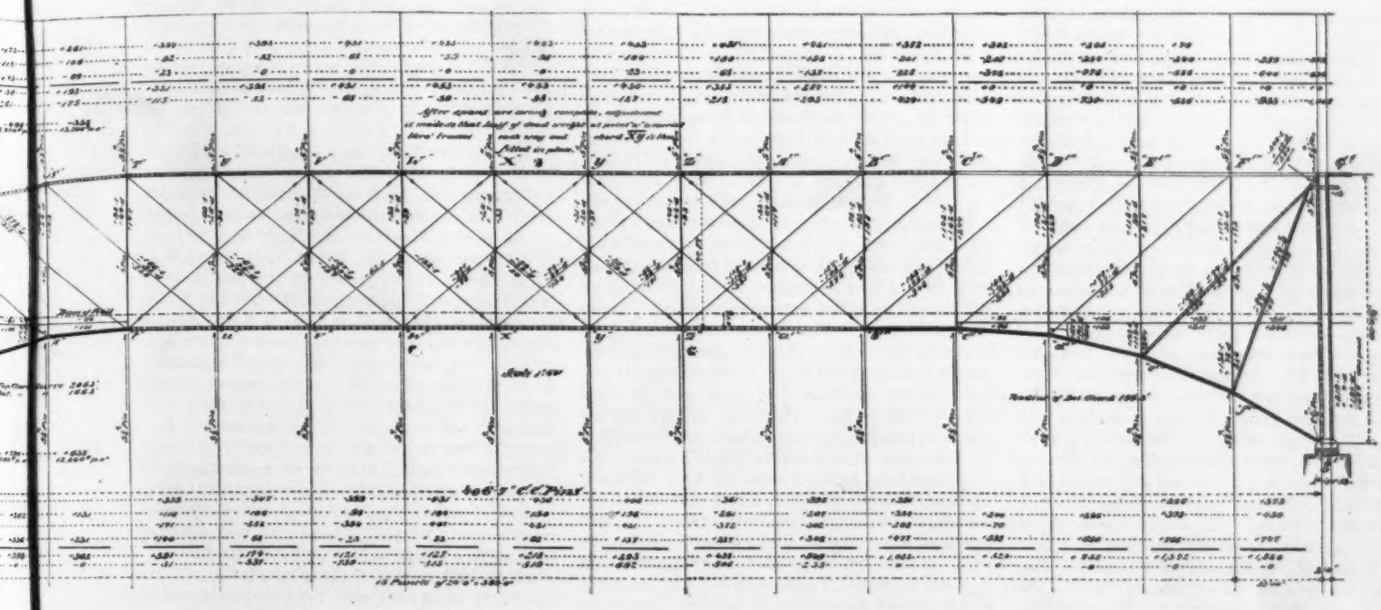
Stringers

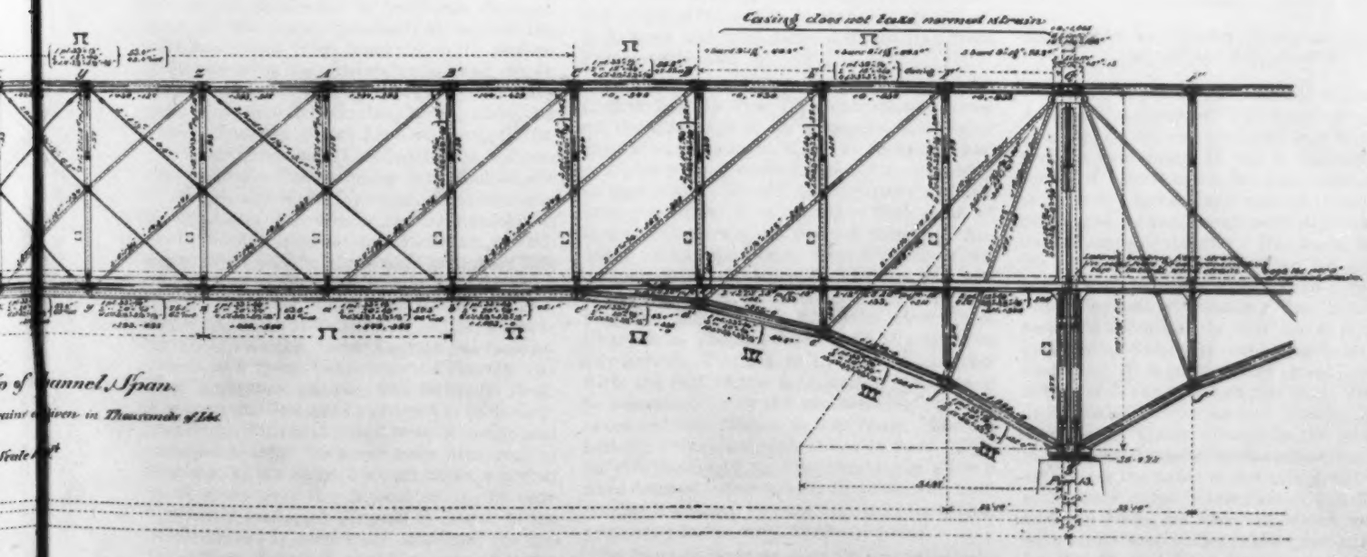
RAILWAY, OVER ST. LAWRENCE RIVER.

MINION BRIDGE CO. CONTRACTORS.

Channel Spans, and Details of Floor System.

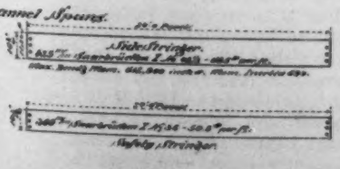






Channel Span.

in Thousands of Lbs.



* *The principles of this design*, upon which the calculations were based, are:

Dead weight strains are cantilevered each way from W.—After dead weight is swung complete and proper adjustments made by means of adjustable tie *W y*, and adjustable beds at ends of flanking spans (*a*) the section *x y* of top chord is rivetted in place, when the *four spans act as continuous, as far as live load is concerned.* In case of unequal settlement of piers, vertical adjustment is made by means of adjustable beds at ends of flanking spans. Observations on ties *W y* and *W u* will show if adjustment at ends of flanking spans is required at all times, after the sleeves on *W y* are locked (and marked) in original position, dividing the panel dead weights at *W*. The erection strains cantilever each way to *z* for convenience.

We had supposed that by this time this safety catch was almost universal, and it is certainly very common, but the Commission's circular compels us to believe that it is less common than we had supposed, and perhaps it is unknown in Massachusetts.

Railroad Building East of Chicago.

The map which we published last week (and which will be followed up by similar maps for the other sections of the country, as already announced) enables anyone who chooses, to obtain a clear idea of just what is doing in the way of railroad building, by a few minutes inspection. Unfortunately, the ins and outs of policy which are at the bottom of the work cannot be shown even on a colored map, and it will perhaps assist to a clear comprehension of the map to make a concise summary of the salient features of the situation.

Doubtless most of our readers were surprised to see in our last week's list the amount of work that is now in progress in the various Canadian provinces east of Manitoba. The mileage under construction in Quebec is of especial interest in view of the prevailing impression as to the conservatism and slowness of that province, although it is to be remembered that nearly all Canadian work is now stimulated by Government subsidies of $3,000 per mile and upwards, The most interesting thing in the work across the border, however, is the extensive scheme which the Canadian Pacific has backed, and will push to an early completion. Unfortunately most of this work is north of the limits of our map; but it is included in the list, and has been frequently referred to in our Construction News. The extension to Sault Ste. Marie, to connect with the American lines now under construction from Minneapolis, St. Paul and Duluth and the rich mining districts in the northern Michigan peninsula, is expected to carry a vast volume of export traffic. It is desired to reach a shipping point for this that shall avoid the dangerous navigation of the St. Lawrence gulf, and allow shipments to continue through most of the winter months. At present the only rail route from Montreal to the eastern Provinces is by the Intercolonial road, which runs far to the north, and makes the distance from Montreal to Moncton, N. B., about 632 miles. The new Short Line will cross the St. Lawrence by the new Lachine bridge. From that point the line is under construction, *via* St. John's and West Farnham, to Sherbrooke P. Q., about 112 miles. Here connection is made with the International Railroad, extending 85 miles east to the Maine boundary line and thence under construction for 128 miles across northern Maine to Mattawamkeag. From this point to Vanceboro', N. B., a trackage right over the Maine Central has been secured: and from Vanceboro to Harvey the New Brunswick railway will be used. From Harvey a line has been surveyed to Salisbury, 113 miles. This is 13 miles from Moncton and makes the total distance from Montreal to Moncton by the Short Line 541 miles, a saving of 90 miles over the Intercolonial. In case Halifax is made the seaport terminal, if the Intercolonial is used from Moncton, the distance from Montreal to tide-water will be 729 miles. From Halifax to Liverpool is 2,480 miles, and much stress is laid on this being a saving of 650 miles over the distance from New York. Probably St. John's or some other port on the Bay of Fundy will contest supremacy with Halifax as a shipping port.

The building of this line across Northern Maine is the cause of the numerous extensions of the Maine roads who desire to tap this transcontinental line and carry some of its traffic to Maine ports. The Boston & Maine system, which is expected soon to cover all northern New England, has also begun construction from North Stratford, N. H., to connect with this line.

The most noticeable feature in southern New England is the New York & Boston Rapid Transit Co's. surveyed line, the actual construction of which has for some time been asserted to be immediately at hand. Another important feature is the work in connection with the new bridge across the Hudson at Poughkeepsie. The syndicate who are building this, propose to control the connecting lines as well. The direct route to New England from Poughkeepsie would be *via* the Poughkeepsie, Hartford & Boston railroad to Boston Corners, and its projected extension to Westfield, Mass.; but the syndicate failed to make satisfactory arrangements with this company and secured control instead of the Hartford & Connecticut Western Railroad. Extensions have been surveyed which will give a line from Poughkeepsie to Springfield, Mass., 137 miles in length, but so crooked and indirect that it is 37 miles longer than the proposed route *via* Boston Corners. For a western connection the syndicate have secured control of the partially constructed Pennsylvania, Slatington & New England Railroad, which connects with the Pine Island branch of the Erie and in all probability will be completed and put in operation. Another proposed route is that of the Port Jervis, Monticello & New York, the completion of which depends on the conclusion of the Pennsylvania to build the proposed extension of the Belvidere division across New Jersey up the Delaware river to Port Jervis. Various other extensions, present and prospective, of the Pennsylvania system are noted by marking with the same number, and summarize as follows: track laid, 25.6 miles; construction, 70 miles; surveys, 43 miles; projected, 310 miles. One of these larger projects which the Pennsylvania managers are said to have in mind has for one object a sort of granger campaign in West Virginia, and for another a connection at Gallipolis, O., with the new Ohio & Northwestern which owns the old Cincinnati & Eastern and is to build a direct line from Portsmouth east.

The Baltimore & Ohio at the time when the project for the New York extension claimed all the attention of its managers, had begun several extensions in West Virginia and had some very good opportunities for enterprise in that State. Should the company's affairs ever get settled, it is probable that some of these projects will be carried through. Another noticeable line in West Virginia is the one which the Norfolk & Western has surveyed to Ironton, Ohio, and still another is the proposed line up the Kanawha river from Charleston. The absolute dearth of activity of any sort in Virginia is in marked contrast with the rest of the map, and is probably to be accounted for by the prevalence of politics, taxes and repudiation in that State. The old historic Commonwealth seems to have fallen on evil days, and no community can show a fixed determination to swindle those who have trusted it without its reacting on its industrial prosperity in the most destructive way.

In Pennsylvania we note the partially built line of the South Pennsylvania, of special interest now in view of its probable completion. It is also of interest to note that much of the activity of the State is in the coal mining districts, as in Ohio.

In Indiana the projected extension of the Evansville & Terre Haute or "Mackey" system from Richmond across the State, is of importance in view of its backing; and still more so is the extension of the "Big Four" (Cincinnati, Indianapolis, St. Louis & Chicago) from Lawrenceburg to Louisville, and from Columbus west to Switz City. From this point the Indiana & Illinois Southern Railroad extends west to Effingham, Ill., 91 miles, and it is proposed to extend it west to St. Louis, thus perfecting the Big Four's title to its long name.

Michigan has a large mileage under construction, most of it, however, in the lumber regions and of little general interest. Across the river, extending from London, Ont., to Windsor, is seen the line which the Canadian Pacific has located and has even secured part of the right of way upon, ready at any time when favorable traffic arrangements cannot be made, to build an independent line to Detroit.

Some portion of the great activity in the "New South" is shown by the appearance of northern Kentucky. It will appear still more clearly in the map we shall soon issue. The two principal lines now building are along the Ohio river, but there is also much activity, present and prospective, in the central part of the State. The principal sources of attraction to Kentucky railroad projectors, however, are the "Breaks of Sandy" and Cumberland Gap, and if but a small portion of the schemes in that region materialize, the present *terra incognita* of eastern Kentucky will be well supplied with the agencies of civilization whose efficiency is referred to elsewhere.

In regard to showing these still doubtful schemes upon our maps, we must repeat that while we rigorously exclude the vast majority of the "new projects" (if we showed them all the surface would be nearly all red) yet the very purpose of the maps requires that we should give all projects that seem to have a solid basis the benefit of a doubt. We do not by any means assume that all or most of the lines shown will in fact be built, but merely imply by showing the line on the map, that according to our best judgment the line is sufficiently well backed to have a very fair chance of being actively pushed within a few months.

The Report on Grades of the American Society of Civil Engineers.

As the Committee on a Student Grade of the American Society of Civil Engineers, whose excellent report we published last week, have now another month in which to complete the forms of amendments recommended, suggestions as to any desirable change therein are in order, and we shall be pleased to give space to such from any quarter. One such, made by Mr. BROOKS, of the Committee, we noted last week, that the new grade should be called Junior instead of Student. The latter name seems on the whole the best, but it is a minor question, and there is something to be said on each side. It is particularly one of those questions which can best be brought up, discussed, and decided at the Annual Meeting, since it requires no further change in the forms submitted than the substitution of one word for the other. As the name of the only grade which a man could enter below that of full Member, and as a grade, we may add, which was taxed with pretty heavy dues ($10 a year, against $15 for Members) it has been generally felt to be objectionable. As the name of the lowest of three grades, taxed with light dues, and to which only quite young men can belong, it is a very different matter. Still, we imagine the name Student will be deemed the best. Until a man can pass the very easy qualifications for Associate Member (24 years of age, with five years experience, or two years after graduation) he is nothing but a student, and it is well he should be reminded of it. He can-

not, if he will, remain a Student more than a year or two longer, but then drops out of the Society unless elected to a higher grade.

The requirement (which appears in two places) that a man must have graduated "after a full course of study" is rather worse than tautology. A graduating degree can rarely be obtained without such full course, and never, in any respectable college, without as great technical knowledge as it would give. If this knowledge has been gained, and a degree given, without such full course, it is to the credit of the candidate rather than otherwise.

The ballot on all questions but elections to membership is given to Associate Members as well as Members, which is as in the Institution and Canadian Society, and seems to us wise. There seems no reason why Associate Members should not vote for officers and on other kindred questions, and even on amendments to the Constitution and by-laws. If there were the least chance that they might band together and vote as a grade against Members as a grade, it might be objectionable, for the grade may well outnumber in time the Member grade, as it does in the Institution. But there is, humanly speaking, no such chance, and as the Member grade is quite sure to be much the largest for many years, it will have the remedy in its own hands at any time, should events indicate that this remote danger may become a real one.

The sweeping provisions that the three junior grades shall have "all the rights and privileges of Members," except the ballot (for the specified Student privileges amount to that practically) seems to us liable to make trouble. It is to be remembered that this is to be the great engineering country. The American Society will, in the natural course of events, far out-number the Institution, and that body, according to the latest report, just received, is made up as follows:

Members	1,581
Associate Members	2,340
Associates	476
Students	934
Total	5,331

The American Society of even 1900 may well be even larger than this. It may be much for the interest of the Society to hold conventions or other special meetings of Members only, or reasons which cannot now even be anticipated may make the sweeping provisions as to "*all* right and privileges" embarrassing. Why should not the three separate clauses as to privileges, which the Committee submit, be condensed into one, to read thus:

"Members only shall have the right to hold office and to vote on admissions to the Society. Both Members and Associate Members shall have the right to vote on all other questions. All grades of the Society shall have the right to receive the Society publications, to present papers and discussions, and to use the library and rooms of the Society and attend its meetings under regulations to be fixed by the Board of Direction."

This leaves the Board of Direction untrammelled to fix the future rights and privileges of all grades. In the future as in the past they will no doubt be as liberal as the best interests of the Society permit.

The new age limits, which have been added to the previous stipulations for the various grades, will, we are confident, meet universal approval. They are: Member, 30 years; Associate Member, 24 years; Associate, 25 years; Student, 18 years. There are a few cases where brilliant men have the qualifications which are contemplated for the highest grade before the age of 30, but it is no great hardship to them to wait a year or two, while there are more cases of men who attain positions of great nominal but little real responsibility at an early age, while better and older men still lack the "responsible charge" implied by a high title. The age limits will also tend to enforce what should be the rule, but is now the exception, that men enter the junior grades first, and are promoted as they advance in experience.

The stipulations as to age and tenure of Students are unfortunately drawn. Entering at 18 *or over*, with no major limit fixed, they might enter at 30 if they chose, and would be very likely to at 23 to 25, and being then entitled to remain as Students for seven years, many of them would be past the age for admission as Member before they need apply for another grade. The Committee state in explanation: "We have thought it well to fix a time, instead of age limit, to continuance in this grade; otherwise those who graduate young and immature would have the advantage of older students;" but while there is force in this position, there is likely to be a nearer equality of conditions if Students are all dropped at 26, than if they are dropped after a seven years tenure beginning at all ages from 18 to 25 or 30.

A merely verbal criticism is that Art. XVIII. in regard to proposals for membership, is needlessly verbose as it stands, being the product of several amendments. With the Committee's further amendments it will contain about twice as many words as are necessary to cover all its provisions, which is done in the following brief form:

Applications for admission to any regular grade of the Society shall contain a statement by the candidate, of his age, residence, the nature and term of his professional service, and that he will conform to the requirements of membership, if elected. Applications for admission as Member, Associate Member or Associate must be indorsed by at least five members, who certify that they personally know the candidate, and that he is worthy of acceptance. A single member in any grade may endorse applications for Students. Students shall be elected by the Board of Direction. Members Associate Members and Associates shall be elected by ballot. In case of transfer from one grade to another candidates shall pay only the difference between the entrance fees of the new and old grades.

While less than half as long, this omits nothing except a sentence as to Fellows which is covered in substance in a later Article.

We mention these brief points with the idea that they may be both useful to the Committee and of interest to the great body of the profession, whether they be in or out of the Society. Every engineer has a prospective or contingent interest, at least, in the organization of this greatest of our Engineering Societies, which bids fair ere many years to greatly extend its field of usefulness. If such a change as is contemplated is to be made at all, it is very desirable that it should be made in the best way, so that no further modifications shall be at any time necessary.

The Canadian Society of Civil Engineers.

A good many of our readers, perhaps, have hardly yet learned that there is such an organization as the Canadian Society of Civil Engineers, as it was only established Feb. 24, 1887, and incorporated June 23, 1887, but it is already a very live institution indeed, and if it can keep up the standard of its first quarterly volume of Transactions, it will not be long in becoming known to engineers all over the world.

The moving spirits in the organization, as is but natural, include many members of the American Society of Civil Engineers, and the Constitution and By-Laws bear evidence in every line that they have been more influenced by that organization than any other, it being a kind of compromise between the English Institution and the American Society. It is therefore both interesting and profitable to see what features of each organization have commended themselves to the Canadian engineers, and in what they both have seemed to be defective.

The membership grades are copied exactly from the Institution, and are Member, Associate Member (the American Junior) Associate and Student. In this the Canadians, we are satisfied, have shown their wisdom. The American grading is much less calculated to promote healthy growth, and the report of the Committee of the American Society published last week affords reasonable grounds for hope that these will be a change made this year which will approximate it much more closely to the English plan, the latter having itself been evolved from something much like the present American grading which was never satisfactory. The present membership and annual dues of the Canadian Society are:

	No.	Dues.
Members	196	$8-$6
Associate Members	56	$6-$4
Associates	20	$3
Students	94	$1
Total Membership	366	

The dues for the first two grades are for resident (within 50 miles of Montreal headquarters) and non-resident separately. The other two grades have no such distinction. There as yet no entrance fee.

The membership is already extremely well distributed, standing in the Membership grade:

Montreal	59	30 p. c.
Ottawa	28	14½ "
Toronto	11	5½ "
Other localities	98	50 "
Total Members	196	100 "

If we remember that there is little more than $\frac{1}{18}$ of the population and probably not $\frac{1}{30}$ of the engineering activity in Canada that there is in the United States, and if we further remember that dues are for every grade, really higher in proportion to what the member obtains than in the American Society, this is a very striking showing, highly creditable to Canadian engineers.

It especially illustrates what may be expected from a Student grade in the American Society, should that body create such a grade with the honest intent to make it a success, as we feel no doubt it will. In either body the only material thing that a Student gains is the Transactions. These are about five or six times as valuable in the American Society as in the Canadian, and may be expected to continue so. He also gains a certain better chance for desirable engagements, and gratifies that *esprit du corps* which is strong in every young man who has much "stuff" in him by becoming an organic part of the Society which represents his profession. Taking all these things together a Canadian Studentship at $1 per year is fairly comparable with an American at $5 or $6.

Yet here we see a body of 94 Students, or more than half the number of Members, gathered in within one year. The American Society, in the same ratio, would very speedily have 600 or 800. If it does not do so, it can only be because of some correctable defect in the organization or management of the grade.

The requirements for Membership are by no means low, and are also well worth pondering by members of the American Society. We give them almost in full.

Member.—Must be at least 25 (American and English 21) "and must have been engaged in some branch of engineering for at least TEN years," including time at college or apprenticeship (American, *five* years after graduation) and must have had responsible charge of work as a Resident or Superintending Engineer, "or held a position of equivalent professional responsibility," (a vague clause apparently inserted for the benefit of college professors) for at least FIVE years (American *one*) "not as a skilled workman merely, but

as an engineer qualified to design and direct engineering works."

These stringent requirements are probably not yet adhered to strictly—neither were they in the American Society in its earlier years—but they show that the Canadian Society is not starting in on a low plane.

Associate Member.—Five years practice or study, two years in actual engineering work; substantially identical with the present American Junior.

Both Members and Associate Members have the right of ballot, as in the Institution:

Associate.—Scientific men who are not practicing engineers; the same as the American Associate or Fellow.

Student.—"Must be at least 16 years of age, and must present a certificate of having successfully passed an examination equivalent to the final examination of a High School, or the matriculation examination of an Art or Science course, and must be pursuing a recognized course of instruction in some branch of engineering, or be receiving a practical training in the profession."

With the possible exception of extending the ballot beyond the grade of Member, this strikes us as a model organization. The American Society might copy it verbatim with great advantage, although perhaps the name Junior might be preferable to Student for the lower grade, all things considered, as we have elsewhere noted.

The governing body consists of a Council of 4 officers and 15 councillors, as in the Institution, five being a quorum, against only 5 directors in the American Society. The latter was well enough in the day of small things, but makes it altogether too much of a close corporation to be permanently desirable, since it throws the whole control of the Society, practically, into three or four hands. They have been good hands so far, but such conditions are wrong in principle.

Students must be proposed by one member, and candidates for all other grades by five members. There is a letter ballot, as in the American Society, but TEN negative votes, instead of *five* only, are required to exclude. The dangerous and unjust power which the American Society now vests in any secret cabal of five members, and which has been so shamefully abused, in a number of cases will, no doubt, be corrected at the next annual meeting.

Finally, a most significant difference between the Canadian Society and both the American and English, is that it provides for the formation of "Branches," or Sections, in the following simple terms, which all members of the American Society will do well to read and ponder:

A local Branch of the Society may be established under the authority of the Council, at the request of not fewer than ten members, who are desirous of forming themselves into such a local branch, in any place not less than one hundred miles distant from the headquarters of the Society, or from any existing branch. The establishment of a Branch shall not release members from any of their obligations to the Society, whether as regards fees or membership in any class.

Local Branches, although formed strictly of members of the Society, may be distinguished by the name of their locality, as for example "The——Branch of the Canadian Society of Civil Engineers."

The officers of local Branches shall be a Chairman and Secretary-Treasurer, who shall be elected by the members of the Branch.

All classes of members of local Branches must be elected by the Society in the usual way, and shall enjoy the privileges, and shall be subject to all the conditions of resident and non-resident members of the Society in their respective classes (see Clauses 14 to 18), and in no case shall their members be added to locally, or otherwise than in the regular prescribed way.

Members of a local Branch shall pay to the Society the fees of a resident member of the Society, and the Society shall remit to the Branch, on application of the Secretary-Treasurer, the difference between a resident and non-resident's fees. The Society shall not be liable for any expenses incurred by a Branch.

The regular meetings in all Branches shall be held on the same date as the corresponding meetings of the Society at headquarters.

In by-laws, rules of order, etc., and in particulars not specially referred to, the Branches shall conform to the methods and rules adopted by the Society.

In other words, if there are enough Members of all grades in any locality to hold local meetings, they are permitted to hold them without forming a separate organization, and all members residing near enough to them are compelled to pay the resident instead of non-resident dues, the difference being paid over to support the local organization. This places all localities on a strictly even plane, and if the same conditions were in force in the United States would probably result in eight or ten of the now local engineering organizations being organized within the Society while otherwise remaining substantially the same. The Canadian and English grades are much more favorable to this result than the American, as they stand to-day, since they offer an acceptable grade for men of all degrees of experience, which the American as yet does not; but should this difficulty be removed, as we trust it soon will be, the Canadian stipulations seem to have been singularly well drawn to obviate all the objections and secure all the advantages which have been alleged in respect to such branches, and to be well adapted in substance for the American Society. The Canadian Society does not in any way attempt to foster or encourage such organizations, and assumes no responsibility in respect to their formation or continuance. It simply says: If they are desired, they can be formed.

The first quarterly publication of the Canadian Society contains five papers, every one of which is of a distinctly high grade, which would honor the Transactions of the American or any other Society. Wise heads have watched its birth and guided its infant steps, and we sincerely hope that its vigorous infancy is only a prophecy of still greater usefulness in youth and manhood.

CORRESPONDENCE.

Note on St. Lawrence Bridge.

Sheffield Scientific School of Yale College,
NEW HAVEN, Conn., Oct. 1, 1887.

EDITOR ENGINEERING NEWS:

I wish to call attention to a remark in the article upon the "Superstructure for the St. Lawrence Bridge," by Mr. J. W. SCHAUB, in your issue of Oct. 1, which might cause misunderstanding.

In giving Prof. MERRIMAN'S formulæ for continuous girder, a foot-note is appended at bottom of page 238, stating that "the above formulæ are given by DU BOIS in the 'Strains in Framed Structures,' page 135, but unfortunately the signs + and — should be reversed."

This would lead the reader to infer that an error is committed in "Strains," where really no error exists, and hence might make trouble.

A reference to page 244 of "Strains" will show that the formulæ are correctly given. The formulæ as given by Mr. SCHAUB are also, I presume, correct. The trouble lies simply in the sign given by convention to a moment. In "Strains" throughout, any moment which would tend to cause tension in the upper chord at pier is considered as *minus*. Prof. MERRIMAN'S convention was the reverse. Change my signs and also the convention and the result is unaffected. As the formulæ given by Mr. SCHAUB now stand, a minus moment means one whose action is to cause *compression* in the upper chord at pier. A plus moment in my formulæ means the same thing. The readers of Mr. SCHAUB'S article should note this, as he neglects to call attention to the significance of the sign of the pier moments. A comparison of my formulæ with Prof. MERRIMAN'S without reference to the conventions adopted, has probably caused Mr. SCHAUB'S misunderstanding. My convention is distinctly stated upon page 137. It is also illustrated upon page 134. It is also adhered to consistently throughout the work, and stated anew in every case. I trust therefore that no reader will be led astray. Mr. SCHAUB'S formulæ will in any given case give the same pier moments as mine with an opposite sign. The significance of his will, however, be the same as mine, a plus moment with him meaning, I presume, the same as a minus moment in "Strains." At any rate, whatever convention Mr. SCHAUB has adopted, I cannot tell directly but only by inference, as he does not state it. But the formula of "Strains" are correct for the convention clearly stated in "Strains."

The work of Prof. MERRIMAN in the *London Phil. Magazine*, for Sept., 1875, which I quote on page 135 of "Strains," I had already given in full in "Elements of Graphical Statics," in 1875. I have, ever since, repeatedly called attention to the elegant results there fully given, but have waited twelve years for the first sign, such as is now given by Mr. SCHAUB, of proper recognition of Prof. MERRIMAN'S work in this direction. As Mr. SCHAUB states, the theorem of three moments is sufficiently well known, but his is the first public acknowledgment I have seen, not made by myself, of the fact that Prof. MERRIMAN has solved the general problem of the application of the theorem to any number of supports, at different levels, different lengths of span, fixed or not at the ends, so that the tedious elimination of pier moments is, once for all, avoided, and the result for any pier given directly, without the long and toilsome process of investigation having to be gone over for each case. It will not detract from the credit due to Prof. MERRIMAN when it is known that this work was done while a graduate student in the Sheffield Scientific School of Yale College. I am glad, at last, to see signs, by those who make use of his formula, of recognition of his work. Certainly no treatment of the theorem of three moments is complete which ignores it.

Respectfully,
A. J. DU BOIS.

The Oswego Runaway Locomotive.

OSWEGO, N. Y., Oct. 5, 1887.

EDITOR ENGINEERING NEWS:

I beg to enclose a slip giving an account of a rather, peculiar incident which occurred here Oct. 3, which may be of interest to you if not already called to your attention. The engine ran about a mile through the town, crossing all the principal business streets, and though no accident occurred save to the fireman of another engine, there were many narrow escapes. Though I did not see the engine, from the testimony of an eye-witness who saw it run across the bridge, and who noticed it particularly, I should say that it did not run more than one-half the fifty miles an hour given in the paper.

The bridge here is about 800 ft. long, double track, and about 50 ft. above the water. The Phœnix train, which was run into was going to the depot, and in a few minutes would have been crossing the bridge with passengers on board. Had the collision occurred on the bridge, it would probably have been much more serious. The injured fireman died the same evening after having his leg amputated.

Yours truly, C. J. MATTISON.

[The details of the accident have been noted in our news page.—ED. ENG. NEWS].

National Sewerage and Sewage Utilization Co.

No. 115 Broadway,
NEW YORK, October 4, 1887.

EDITOR ENGINEERING NEWS:

In your issue of the 1st. inst. I notice a paragraph stating that the Improved Sewerage and Sewage Utilization Company acting under the patents of W. SCOTT WEST, and organized in 1873, has been placed in the hands of a Receiver on the application of Mr. A. J. ROBINSON.

While the above statement is correct, I desire to call the attention of parties interested, and the public, to the fact that the Company referred to possesses a license for operating the "West System of Sewerage" for the States of New York, New Jersey and Connecticut only. *The National Sewerage and Sewage Utilization Co.* is in a healthy condition as its last report to the State authorities, filed January

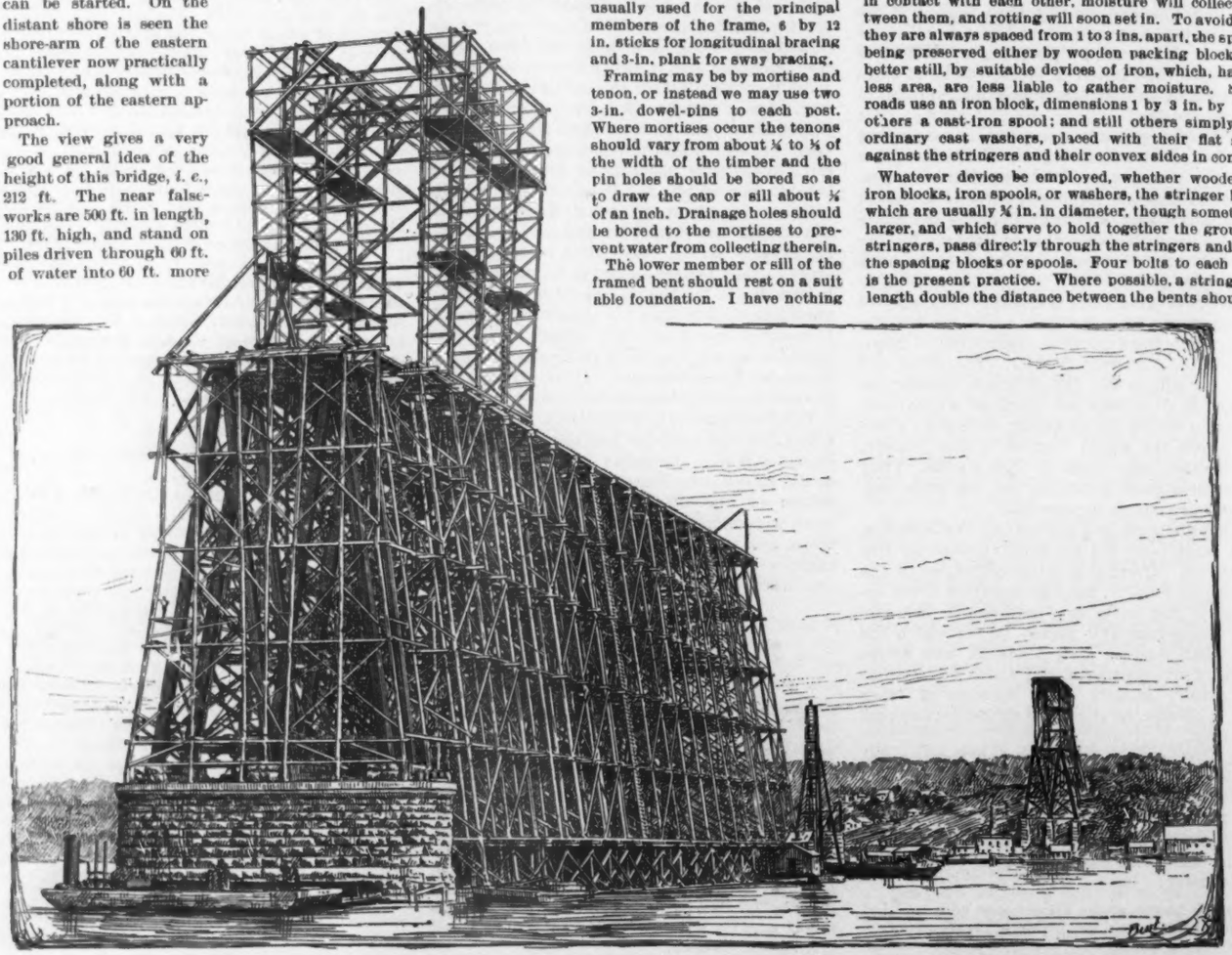
19, 1887, will amply testify—and, as the paragraph alluded to may be misunderstood and be misleading, the names of the companies being so similar, *The National Sewerage and Sewage Utilization Co.* takes this method of disabusing the minds of parties interested, and asks you to insert the statement in your valuable paper for the purpose above mentioned.

J. D. OTTIWELL, President.

Progress on the Poughkeepsie Bridge.

The accompanying illustration shows progress on the Poughkeepsie bridge to within the last few weeks. The photograph from which the cut is made is taken from the west bank of the river, and shows in the foreground the extreme western river pier of the four main piers. The false-works are for the erection of the western connecting span which must be built before the adjoining cantilever spans can be started. On the distant shore is seen the shore-arm of the eastern cantilever now practically completed, along with a portion of the eastern approach.

The view gives a very good general idea of the height of this bridge, *i. e.*, 212 ft. The near false-works are 500 ft. in length, 130 ft. high, and stand on piles driven through 60 ft. of water into 60 ft. more of mud. The traveler shown on top is 90 ft. high. This staging contains about 1,300,000 ft. B. M. of timber, and rests upon 528 piles 130 ft. long each. It was planned and erected in less than two months, and is larger than the famed false-works put up near London, to test the soundness of the theories of construction of the designer of the Sukkur bridge intended for India, and in which two years were consumed in setting up the timber false-works alone. We acknowledge our indebtedness to Mr. THOMAS C. CLARKE, of the Union Bridge Co., and Mr. J. F. O'ROURKE, Chief Engineer for the Union Bridge Co., for the original photograph and other courtesies. In a following issue we will give an illustrated description of the foundations and substructure of this bridge.



Poughkeepsie Brid ; Showing Falseworks and Traveller of Western Connecting Span and Progress to Sept. 15, 1887.

J. GOULD is proprietor of the largest watering place in the world—his office.—*Ex.*

Railway Trestles.*

(*Continued from page 256.*)

Framed Bents.—The framed bent is of different construction. It is usually composed of 12 by 12 in. timbers, and in its most ordinary form consists of a sill into which is secured usually by mortise and tenon two upright or plumb posts placed directly under the track stringers, two batter or inclined posts, one on each side of each plumb post, with a 12 by 12 in. cap supporting the stringers. Sometimes the batter posts have square ends let into the sill and are secured thereto by iron straps. The usual batter is about 3 ins. per foot. The forms of framing differ greatly, varying with the height, distance between centers, character of traffic, and the ideas of each constructor. The object sought is to form a rigid framework of timber strong enough to sustain the weight of the train and properly stiffened against lateral stresses, and the result is reached in various ways.

The calculation of stresses and dimensioning of pieces calls for no special remark. 12 by 12 in. sticks are usually used for the principal members of the frame, 6 by 12 in. sticks for longitudinal bracing and 3-in. plank for sway bracing.

Framing may be by mortise and tenon, or instead we may use two 3-in. dowel-pins to each post. Where mortises occur the tenons should vary from about ¼ to ⅓ of the width of the timber and the pin holes should be bored so as to draw the cap or sill about ¼ of an inch. Drainage holes should be bored to the mortises to prevent water from collecting therein.

The lower member or sill of the framed bent should rest on a suitable foundation. I have nothing but disapproval for the practice of placing sills in a shallow trench and then partially covering them up with earth. Mud sills or timbers 4 to 6 ft. long, bedded in the earth at right angles to the sill as a foundation for it, are an improvement, but not all that could be desired. Better practice places the sill on a foundation of piling, stone blocks, or on some not too expensive form of masonry.

Corbels.—Sometimes the stringer ends rest directly upon the caps, and sometimes we find a "corbel" interposed between the cap and the stringer. Concerning corbels there is some diversity of opinion, but the question becomes more important as the structure increases in height and span. In favor of them it is urged that the clear span can be reduced by about the length of the corbel, thus enabling lighter stringers to be used with equal safety, and also that they afford more end bearing to the stringers. Those who object to them say that they are extra and unnecessary pieces in the structure, increasing both labor and quantity of material; that the end of the corbel is a fulcrum, on which the stringer pivots in its deflection, causing upward motion over the cap thus tending to unnecessary strain and disarrangement in the stringer system; that by collecting moisture at the stringer ends they lead to early decay in the most vital part of the structure; also that the stability of the structure is impaired in so far as the center of gravity of the train is raised by them higher above the cap, which is always a firmer support to the stringer than any stick of timber interposed between them. For myself, while not greatly in favor of corbels, I do not consider the question as entirely settled, and should be glad to have an expression of opinion on the subject.

Stringers.—We pass now to the stringers. They vary in depth from 12 to 18 ins., though 16 ins. is a very common depth. We may find either one, two or even three grouped under each rail, with or without outer or "jack" stringers.

Evidently, if several stringers are placed side by side in contact with each other, moisture will collect between them, and rotting will soon set in. To avoid this they are always spaced from 1 to 3 ins. apart, the spaces being preserved either by wooden packing blocks, or better still, by suitable devices of iron, which, having less area, are less liable to gather moisture. Some roads use an iron block, dimensions 1 by 3 in. by 1 ft.; others a cast-iron spool; and still others simply two ordinary cast washers, placed with their flat sides against the stringers and their convex sides in contact.

Whatever device be employed, whether wooden or iron blocks, iron spools, or washers, the stringer bolts, which are usually ¾ in. in diameter, though sometimes larger, and which serve to hold together the group of stringers, pass directly through the stringers and also the spacing blocks or spools. Four bolts to each joint is the present practice. Where possible, a stringer in length double the distance between the bents should be used, in which case the stringers when arranged in groups of twos are laid to break joints, each joint being central over a cap, stringer bolts and spacing blocks being used at the center and at each end of each stringer, and occasionally also at the center of span half way between the bents.

To secure the stringers against shifting laterally or longitudinally, each stringer continuous over a cap should be drift-bolted thereto, or otherwise secured in place. In some trestles, heavy blocks of wood are spiked, or iron angle plates are bolted, to the cap on each side of the stringer; again, the wooden key used for spacing the stringers is let into the cap; and sometimes the stringers are also boxed into the cap, or their ends notched down on it. Drift-bolting to the cap, however, avoids cutting the cap or stringer, and is good practice. The bolts should be about 1¼ in. in diameter and extend not less than 8 ins. into the cap.

Jack-Stringers.—Where outer or jack-stringers are used they are generally designed to come into play mainly in cases of derailment by affording a support to

* A paper read before the Illinois Society of Engineers and Surveyors, by EDWIN A. HILL, of Indianapolis, Ind.

the ends of long ties, the stringers directly under the rail being relied on for carrying the train. Jack-stringers, besides entailing considerable extra expense for labor and material, are in the way when replacing track stringers, and are not always in favor with the road department, though of good service in case of accident. My own preference is for a wide floor system and double guard-rail.

Formulæ for Track Stringers.—In the following formulæ:

W, (pounds) = assumed maximum center load.
S, " = maximum shear at any point in the stringer.
s, (pounds) = weight of stringers, track, etc., for one span, which, when unknown, may be roughly assumed at 375 lbs. per lin. ft.
w' w'' w''' etc. (pounds) = loads on the several axles of the rolling stock.
a' a'' a''' etc. (inches) = distance from said loads to edge of nearest cap.
b, (inches) = combined breath of all track stringers.
d, " = common depth " " "
l, " = clear span " " "
c, " = width of cap.
C_1, (pounds) = constant for transverse stress.
C_2, " = " " shearing stress.
C_3, " = " " end crushing.
f, = factor of safety.

Data for Weight of Trestles per Lineal Foot (Approximate).—The weight of timber is taken at 3 lbs. per ft. B. M. The weight of rails equals two-thirds of the number of pounds per yard. All values are given per lin. ft. of track.

	Weight in Pounds.
Rails	From 37 to 50
Spikes, splices, bolts, nuts, washers, etc	" 6 " 9
Ties, 8 by 6 ins. — 9 ft. = 36 ft. B. M., spaced 18 in., 24 ft. B. M.	" 72
Ties, 8 by 7 ins. — 14. = 65 ft. B. M., spaced 12 ins, 65 ft. B. M	" 195
Guard-rails, 2 sticks 6 by 6 ins., 6 ft. B. M.	" 18 " 51
" 4 " 8 by 7 ins., 17 ft. B. M.	
Stringers, 4 pieces, each 6 by 14 ins	" 84
" 6 " 7 by 14 ins	" 147
Cap, averaged at from 12 to 16 ft. B. M.	" 36 " 48
Total weight per lin. ft. of span	" 253 to 500

$\frac{S}{2}$ = from 125 to 250 lbs. × clear span in feet.

FORMULÆ FOR TRACK STRINGERS.

Sought.	Dimensions in inches.	Loads in pounds.	Crushing at ends.	Shearing Stresses	Transverse Stresses	Maximum safe center load in lading stringers, track, etc.	Maximum safe shear and crushing stress	Actual factor of safety
	$W_1 = W + \frac{s}{2}$	$S_1 = S + \frac{s}{2}$						
b = Least breadth	$b = \frac{S_1 f}{C_2 d}$	$S_1 = \frac{C_2 b d}{f}$	$b = \frac{S_1 f}{C_3 c}$	$b = \frac{S_1 f}{C_2 d}$	$b = \frac{W_1 l f}{C_1 d^2}$	$W_1 = \frac{C_1 b d^2}{l f}$	$S_1 = \frac{C_2 b c}{f}$	$f = \frac{C_2 b c}{S_1}$
d = Least depth	Not limited by end crushing		Not limited by end crushing	$d = \frac{S_1 f}{C_2 b}$	$d = \sqrt{\frac{W_1 l f}{C_1 b}}$		$S_1 = \frac{C_2 b d}{f}$	$f = \frac{C_2 b d}{S_1}$
l = Greatest length			$l = \frac{C_3 b d_1}{W_1 f}$	Not limited by shearing stress	$l = \frac{C_1 b d^2}{W_1 f}$			
c = Least width of cap	$c = \frac{S_1 f}{C_3 b}$		Not limited by end crushing	Not limited by shearing stress	Not limited by transverse stress.	$W_1 = \frac{C_1 b d^2}{l f}$		
W_1 = Maximum safe center load in lading stringers, track, etc.								$f = \frac{C_1 b d^2}{W_1 l}$
S_1 = Maximum safe shear and crushing stress								
f = Actual factor of safety								

For Inspection Work. For New Construction.

USUAL VALUE OF f = FACTOR OF SAFETY.

	Transverse and Shearing Stress.	End Crushing.
For Elastic Limit	e = from 3. to 4.	
For Impact	i = " 1.5 to 1.5	i = from 1.5 to 1.5
For Ordin'y Defects	d = " 1.5 to 1.7	d = " 1.5 " 1.7
" Non-continuity of Stringers		m = " 1. " 1.4
Continued Product	$f = e \times i \times d$ = " 6.75 to 10.2	$f = i \times d \times m$ = 2.25 3.75

The following table of constants is based on the data of TRAUTWINE.

In planning new work, having obtained values for W and S by the methods explained below, the formulæ of the first four lines may be used with suitable values for f and C to determine the limiting dimensions for stringers.

In inspecting existing trestlework, we use the remaining formulæ to determine whether the actual loads and factors are sufficiently safe with a view to strengthening them if necessary.

The factor of safety f occurring in the fo[illegible] formulæ really represents the continued product of several factors, introduced *first*, to avoid straining the timber beyond the elastic limit; *second*, to allow for the impact of the moving load; and *third*, to allow for ordinary imperfections of timber, since the constants are derived mainly from experiments on small specimens whose perfections are seldom realized in practice.

CONSTANTS FOR USE IN ABOVE FORMULÆ.

TIMBER	C_1 Coalescent breaking center load in lbs. b and l = 1".	C_2* Shearing strength transverse to fibre, lbs. p. sq. in.	C_3 Stress in lbs per sq. in. to produce indentation of .01 in.	C_3 Stress in lbs per sq. in. to produce indentation of .1 in
American White Pine	5400	2500	300	600
Yellow Pine, best	6000	4300	500	1000
White Oak	7200	4400	800	1600
Spruce	5400	3250	350	700

*Stringers strong enough to withstand the transverse stresses are usually amply safe against shearing stress.

The elastic limit for wooden beams usually lies somewhere between ⅓ and ½ of the ultimate breaking strain. Reducing the constant to ⅓ or ¼ of its tabular value to avoid stresses beyond this limit is the same as giving to f values of 3 and 4 respectively.

Impact.—A load suddenly applied is considered to have twice the destructive effect of a static load, and a heavy train coming swiftly on to a bridge to occupy a position intermediate between the two. Hence for short spans we may say that the motion increases the destructive effect 50 per cent., or what is the same thing reduces the constant by ⅓ part, which is equivalent to assuming $f = \frac{3}{2}$.

Ordinary imperfections are such as knots, crooked grain, improper seasoning, wind shakes and cracks, natural variations in strength owing to different conditions of growth, etc. The authorities usually advise a reduction of the constant of at least ⅓ to allow for loss of strength from these causes which would correspond to f taken equal as before to $\frac{3}{2}$; but as 10 is an almost universally accepted value for f; being the continued product of these several component parts of f, we may take as an allowance for ordinary defects of timber f varying from $\frac{3}{2}$ to $\frac{5}{3}$ which will give us the following result applicable alike to transverse and shearing strains:

For Elastic Limit	e =	from 3. to 4.
" Impact	i =	" 1.5 to 1.5
" Ordinary Defects	d =	" 1.5 to 1.7
$f = e \times i \times d$		" 6.75 to 10.2

With exceptionally good timber d may be taken even lower than 1.5 and with very poor stuff must be even greater than 1.7. Some conception of the elements which combine to form the value of f is useful when f in an existing structure figures lower than we consider safe; thus if we find in a given trestle that f only figures 5.5 instead of 10, as we would wish to find it, if we can agree to the foregoing analysis of f, assuming the timber to be of good quality, we may reason as follows:

By slowing down all trains we make $i = 1$, and assuming $e = 3.5$ and f 5.5 as already found, we then have from the equation $f = e\,i\,d$, $d = \frac{f}{e\,i} = \frac{5.5}{3.5} = 1.57$.

This being a permissible value of d, we could still allow the trestle to be used until it could be properly strengthened, provided we slowed down all our trains.

A similar course of reasoning can be pursued with reference to the factor of safety against end crushing.

For impact we may take $i = 1.5$, and for ordinary defects of timber d = from 1.5 to 1.7. We need, however, to consider the effect of deflections in a non-continuous stringer in raising the end and rendering the bearing imperfect and partial. With a 12-in. cap and a stringer deflection not exceeding 1-120 of the span, an indentation of about 1-200 of an inch will occur at the edge before the end attains its bearing, and the loads required to produce 1-100 of an inch indentation with continuous and non-contiuous stringers respectively, may be roughly assumed as in the proportion of 4 to 3. To allow, for this imperfection of end bearing we should for non-continuous stringers reduce the constant for 1-100 indentation to ¾ of its tabular value or take $f = \frac{4}{3} = 1.4$ cearly. Doubling the load produces ten times as much indentation, so that with an indentation of 1-10 of an inch the constant would not be materially reduced; hence in allowing for non-continuous stringers; denoting the new component of f by m, we take m varying from 1 for continuous to 1.4 for non-continuous stringers and, as before we have the following equation and table:

For Impact	i =	1.5 1.5
" Ordinary Defects	d	from 1.5 to 1.7
" Non-Continuity of Stringers	m =	" 1.0 to 1.4
$f = i \times d \times m$ =		" 2.25 to 3.75

The above factor of safety 3.75 seems small because the constant C_3 is for use with an indentation within the crushing limit of the material, while the factors for shear and transverse stresses are for use with constants taken at the point of rupture. With $f = 3.75$ and C_3 (for indentation .01 in.) = 300 lbs. per sq. in. for white pine the safe stress = 300 ÷ 3.75 80 lbs.

TRAUTWINE gives 800 lbs. per sq. in. as the crushing pressure for white pine; and a stress of 80 lbs. has a factor of safety of 10, so that the factors 2.25 to 3.75 with constants for an indentation of 1-100 in. really correspond to f varying from 6 to 10 with TRAUTWINE'S value of 800 lbs. per sq. in. as the resistance to crushing. In this connection consult TRAUTWINE.

As a rule the authorities preserve a discreet silence on this topic, so that it is with some hesitation that I advance my own views as to the proper values to assign to f and C_3. It is quite likely, however, that in the average trestle the deflection exceeds 1-1200 of the span, and that on the other hand, an indentation considerably greater than .01 in. would not materially injure the stringer ends, but as these facts tend to neutralize each other I presume the values suggested for f are not greatly in error.

Transverse Stress on the Stringers and Computation of W and S.—I have already discussed the subject of the rolling load. 3,500 lbs. per ft. headed by 50,000 lbs. of concentrated load, however, is at present advocated more particularly for dimensioning large and important structures of iron where strengthening is practically out of the question than for use with such structures as are here discussed. No such precautions are necessary or would seem to me good practice with pieces so easily replaced as wooden stringers; and yet we should not lose sight of the important fact that rolling loads are constantly growing heavier. With one-story trestles and 12-in. caps, 15 ft. is about the maximum clear span for the stringers: and at present, with but few exceptions, the stringer sustains its greatest stress from the drivers of a modern consolidation engine. 100,000 lbs. upon a wheel base of 14 to 15 ft. is not unknown, though as yet confined mainly to the more important lines of road, though recent specifications on a western road increase this to 30,000 lbs. on each of four driving axles.

TO BE CONTINUED.

PERSONAL.

ROBERT GARRETT, late President of the B. & O. R. R. Co. has been elected a Director in the B. & O. Co., and also re-elected a Director of the Ohio & Mississippi R. R. Co.

MR. B. C. BOSWORTH, of Denver, Col., has been appointed Superintendent of Machinery for the Colorado Midland R. R., with office at Colorado City.

MR. ISAAC DONOVAN, a railroad contractor, died Oct. 9 at his residence near Mobile, Ala. He was a native of South Carolina.

MR. E. H. HARRIMAN, of New York, has been elected Vice President of the Illinois Central R. R. Co., and will make his headquarters at Chicago.

MR. WM. TORRENCE has been appointed Master Mechanic of the Ohio Valley R. R., with headquarters at De Koven, Ky. He is the son of Mr. JOHN TORRENCE, Master Mechanic of the Evansville & Terre Haute R. R.

MR. CHARLES GIBSON, of Louisville, Ky., has been elected President of the Louisville Bridge Co., in the place of Mr. STANIFORD, deceased.

MR. M. REEDY has been appointed Road-master of the St. Louis, Vandalia & Terre Haute R. R. between Terre Haute & St. Louis.

MR. EDWARD THACHER, Chief Engineer of the Keystone Bridge Co., has accepted the position of Chief Engineer to the new Decatur Bridge Co., recently organized at Decatur, Ala., and will proceed to his new field in a few weeks.

MR. JAMES ROSS, M. Am. Soc. C. E., formerly Chief Engineer and Manager of Construction of the Mountain division, Canadian Pacific Ry., in Northwestern British Columbia, has received the contract on the Eastern extension of the same road from Sherbrooke to Magog. A bridge is to be built over the Magog and a trestle 3,000 ft. long near Easton.

MR. J. W. SCHAUB announces by circular that he has opened an office at 30 Hospital street, Montreal, Canada, as Civil and Consulting Engineer; his specialties being the construction of bridges, roofs and viaducts, structural iron work in all its branches, foundations, etc.

MR. J. C. MONROE, Master Mechanic of the International & Great Northern R. R., at Palestine, Tex., has accepted the position of Master Mechanic of the Memphis, Fort Scott & Gulf R. R., with headquarters at Memphis, Tenn. He will be succeeded by Mr. S. H. SPANGLER.

Mr. JULIUS H. STRIEDINGER, M. Am. Soc. C. E., who for the past two years has been engaged in extensive engineering works for the development of the United States of Colombia, has recently accepted an offer to report upon some mining property in California.

Prof. GEORGE FORBES, the well-known English Scientist, is now in New York for the purpose of exhibiting his Coloumb meter at the Electrical Exhibition of the American Institute. The Coloumb meter has been devised for measuring the consumption of electricity with either continuous or alternate currents.

Mr. STEVENSON TOWLE, M. Am. Soc. C. E., sails for Europe on the 19th, inst. to be absent until May, 1888. During his absence abroad he will visit and inspect the methods of sewerage, the manner of disposal of sewage, and the machinery and appliances used by the Public Works in all the principal cities and towns in Europe.

SOCIETY PROCEEDINGS.

American Institute of Electrial Engineers.—The second special meeting of the season was held at the House of the American Society of Civil Engineers, on Tuesday, Oct. 11. A large number of electricians were present.

Prof. GEO. FORBES, the English scientist and the inventor of the Coloumb electric meter, described his apparatus and practically demonstrated its use for measuring the consumption of electricity with either continuous or alternate currents.

The meeting was followed by a collation and reception to Prof. FORBES' on behalf of the Institute.

Technischer Verein.—At the last annual meeting of the German Technical Society, of New York, the following officers were elected: President, G. W. WUNDRAU, M. E.; Vice President, E. A. GIESLER, C. E.; Corresponding Secretary, H. W. FABIAN, Architect; Prot. Secretary, E. L. HEUSNER, M. E.; Treasurer, A. DRÖGMUNDT, M. E.; Librarian, P. SCHMALTZ, M. E. The Chairman of Sect. I, 'Civil Engineering, is W. P. GERHARD, with 48 Members; Sect. II, Mechanical Engineering, O. PULLER, 101 Members; Sect. III, Architects, R. STRICKER, 35 Members; Sect. IV, Chemists, Dr. M. FIEDLER, 34 Members; total, 218 Members. The headquarters of the Society are at 194 Third avenue.

New England Road-Masters' Association.—A call has been issued for the Fifth Annual Meeting of the Association, to be held at the United States Hotel, Hartford, Conn., Oct. 19 and 20, 1887. Meeting will be called at 1.30 P. M., Oct. 19, and with proper intermissions there will be work done until adjournment on evening of Oct. 20.

After the regular annual business of the Association, viz.: Reading of the minutes of last meeting, enrollment of new members, reading communications, election of officers, report of committees, unfinished and miscellaneous business, there will be discussed the following questions:

"Economy of Labor and Material in Maintenance of Track"—The proper length of a section; number of men to the section; method of systematizing the labor and material used and what work should be done at different seasons of the year.

"Guard Rails at Frogs and Switches"—Length and correct form of same; the flangeway and gauge for same; manner of fastening to prevent spreading or turning over.

"Guard Rails at Bridges, with Bridge Floor"—Give facts of their benefit, where derailed trucks have passed over same in safety.

"Foot Guards at Frogs, Switches and Guard Rails"—The practical benefit of same; form and cost of maintaining same.

Frogs, Switches, Joints, Rail Sections, Road Tools, Ballast, Nut Locks and Elevation of Curves.

"Questions and Resolutions laid over from last annual meeting"—Review of previous years' discussions.

There have been committees appointed on each question, who will report on same as each question is open for discussion.

LATEST CHANGES OF ADDRESS, AMERICAN SOCIETY OF CIVIL ENGINEERS.

JAMES G. DAGRON, Manager Bridge and Construction Dept., Pencoyd Iron Works, Pencoyd, Pa.

EDWARD C. KINNEY, Asst. to Chief Engr. Union Pacific Ry., Denver, Col.

JULIUS W. SCHAUB, 30 Hospital street, Montreal Canada.

A. T. TOMLINSON Engineering Dept., Denver & Rio Grande R. R., Leadville, Col.

SAMUEL T. WAGNER, Supt. Shops, Phœnix Iron Co. Phœnixville, Pa.

Subscriptions to the Building Fund are to date, as follows:

Subscriptions previously reported	$8,485.00
J. Imbrie Miller	135.50
	$8,620.50

The Weather of the United States for the Month of September, 1887.

[As respects the elements of most interest to engineers.]
According to special returns from the Chief Signal Officer of the U. S. Army.

STATION.	Temperature. Degrees Fah.				Wind Velocity. Miles per hour.			Precipitation. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average	Max.	Direction. Max.	Total.	Hardest in 24 hours.	No. rainy days.
NORTHERN CITIES.										
Northfield, Vt	52.6	78.7	29.2	49.5	7.6	30	S	1.78	0.63	11
Portland, Me	57.1	74.9	36.5	38.4	12.2	27	SW	0.70	0.38	6
New York City	63.1	69.9	56.3	13.6	7.5	30	SW	2.30	0.98	11
Pittsburg, Pa	65.1	91.5	36.3	55.2	5.4	20	NE & SW	2.03	0.85	14
Chicago, Ill	52.1	91.7	37.8	53.9	11.2	36	E	4.03	1.33	15
Omaha, Neb	65.3	92.1	38.9	53.2	8.1	36	S	2.44	1.02	8
St. Paul, Minn	55.8	83.2	33.5	49.7	5.4	25	SE & W	4.35	2.35	11
Duluth, Minn	55.4	86.2	36.1	50.1	7.1	35	SW	2.68	0.80	10
Bismarck, Dak	57.5	85.3	28.0	57.3	8.2	36	NW	1.35	0.64	5
Average	58.4	83.7	33.0	46.8	8.1	30.6		2.41	1.00	9
SOUTHERN CITIES.										
Washington City	65.0	90.0	40.0	50.0	4.0	24	N	3.12	0.88	12
Louisville, Ky.	70.8	94.5	42.3	52.2	5.7	24	W	2.84	1.62	12
St. Louis, Mo.	70.0	97.4	44.8	52.6	7.2	30	NW	2.47	0.89	8
Savannah, Ga	73.3	93.1	50.0	43.1	7.5	30	E & W	1.97	0.82	7
Leavenworth, Kan.	66.7	94.7	43.0	51.7	6.2	27	S	5.73	1.74	12
Jacksonville, Fla	76.0	84.2	68.7	15.5	7.0	24	NE	9.40	3.88	16
Chattanooga, Tenn	71.0	95.0	40 6	54.4	4.7	23	SE	3.60	2.96	9
New Orleans, La	77.3	94.0	60.1	33.9	7.9	38	NE	6.51	2.88	7
Memphis, Tenn.	73.9	98.7	49.2	49.5	5.6	23	N	2.15	1.21	9
Palestine, Tex	73.2	92.4	50.4	42.0	7.3	26	NW	2.20	1.78	7
Average	71.9	93.4	48.9	44.5	6.3	26.9		4.00	1.97	9.9
FAR WESTERN CITIES.										
elena, Mont	56.0	81.1	31.8	49.3	6.8	30	SW	0.50	0.37	6
ort Angeles, W. T		Not yet received.								
San Francisco, Cal.	60.4	90.0	49.9	39.1	8.6	35	W	0.29	0.18	5
Salt Lake City, U	65.7	89.9	39.5	50.4	5.2	32	NW	0.55	0.37	4
Denver, Col	63.1	87.6	35.0	52.6	6.9	42	W	0.97	0.39	9
Yuma, Ariz	84.7	105.4	62.5	42.9	4.8	38	S	1.09	1.09	2
Santa Fé, N. M.		Not yet received.								
Average	66	90.6	43.7	46.9	6.5	35.4		0.68	0.48	5.2

Notes upon Railway Construction in the River Plate, Argentine Republic.*

The Province of Buenos Ayres, one of the largest provinces of the Argentine Republic, extends more than 400 miles south from the capital, Buenos Ayres, past the seaport of Bahia Blanca; and from the seaboard on the east to about 300 miles inland. It is an immense plain peculiarly adapted for railways, very little earth-work being required; in fact, only sufficient to give the necessary headway for the rivers and small streams which run sluggishly across the country from west to east.

The principal railway, the Great Southern, was commenced about 1860, starting from Buenos Ayres southwards. Extensions of this line have been made from time to time, until now it has a mileage of over 800 miles, of 5 ft. 6 ins. gauge, and some of the trains attain a speed of 45 miles per hour.

The great difficulty in the construction of this railway was the entire absence of any ordinary ballast. No stones, gravel, nor sand were to be found in any part of the province, with the exception of one small range of granite rocks, extending from the town of Tandil, about 300 miles south of Buenos Ayres, for 50 miles or so to the coast. The geological features of the ground are generally as follows: A rich loamy black soil to about 18 ins. below the surface, with a bed 2 to 5 ft. thick of yellowish clay beneath (both the black soil and clay being entirely without stones); below this again is found white "tosca," differing greatly in hardness. This tosca is from 1 ft. to 4 ft. in thickness, and is composed of from 35 to 75 per cent. of pure lime. These conditions vary but little over the whole tract of country and one of the difficulties which presented itself to the first engineers, and which, although overcome to a great extent by them, was also a difficulty to the author when constructing the last extensions for the company, was the important question of ballast. The choice of ballast was naturally limited to two out of the three strata mentioned above, namely, tosca and the black earth, although the lightest clay was originally tried on part of the line with bad effects. Tosca being the more difficult to get at, and as pits would have had to be opened over a large area and at great expense, black earth was tried and found to be most successful. The black loamy vegetable soil taken from just below the grass, and with care that the soil should be from the highest points of the plain, makes the best ballast possible of attainment; and the whole of the Great Southern Railway of Buenos Ayres, and other railways in the surrounding districts, are thus ballasted. This ballast gives a firm and dry bed to the sleepers, and the road being once well packed, keeps solid and good for a long time, with heavy traffic; the heaviest rain has little effect upon it, the water seeming to evaporate, leaving the ballast dry and good. One of the chief drawbacks till lately was the dust in summer drawn up by the draught of the trains, causing great inconvenience to passengers, and damaging the rolling-stock of the company by getting into the bearings of the engines and the coach axles. By letting the fine grass grow all over the surface this evil has been done away with to a large extent, and the present ballast of the Great Southern Railway permanent-way is, perhaps, as good as any gravel or stone, certainly better than sand used sometimes on other lines. The author has not had an opportunity of learning whether this particular kind of ballast has been used in other countries where ordinary ballast is not available, but he can guarantee that, under similar conditions to those of the railways in the Province of the Buenos Ayres, a trial of loamy black earth—no clay to be mixed with it, even to the smallest degree—will be found most satisfactory

Where limestone is scarce, it being only found near the small towns of Tandil and Hinojo, the author tried the experiment of burning the hardest white tosca in order to get quick-lime. This was very successful, and for every 100 lbs. of the best selected tosca put into the kiln, from 60 to 80 lbs. of good hydraulic quick-lime were obtained, lime which gave the greatest satisfaction to all the inspecting engineers.

The tosca is easily excavated and burnt. The process is very simple, and, as carried out by the author, is as follows:—A small hill or rising ground is selected where the best tosca is to be found; an inclined plane is cut down into it until a face of say 15 ft. in height is obtained. At the bottom of this inclined plane the fire is made against the face of tosca; in this way the natural ground forms the kiln, and all expense of building a kiln is done away with. It is generally necessary to line the lower part of the kiln with hard bricks.

As there is an entire absence of ordinary fuel, there being neither coal nor wood, the fuel used all

*By THOMAS HOLMES PERRY, Assoc. M. Inst. C. E., from Selected Papers; Institution of Civil Engineers.

over the country is dried sheep's dung, called "bosta." This is collected from sheep corrals, which have been used for shutting in the flocks for two, or three, or more years. It is then dug out in squares about 8 in. by 8 in. by 4 in., and open-stacked in walls to be dried by the sun and air. When dried, it is an excellent fuel. It has a greater heating power than coal, and is used, not only for all domestic purposes, but for burning the hard limestone where found, and by the author when burning hard tosca.

Another feature of railway construction in the River Plate is the excellent quality of the wood, suitable either for bridges, wall-plates, sleepers, or any construction where great strength combined with durability is required. Perhaps the best of these woods is the "Quebracho," which is obtained from the northern provinces of the Argentine Republic, and shipped down the river to Buenos Ayres, Montevideo, and other southern ports. The wood is red, close, and short-grained (this latter is its only drawback, as in rough handling it may break), and has practically a never-ending life. When cut from large trees, and free from sap, it lasts so long that no railway has been made a sufficient time in the River Plate by which to test its life. Another advantage, which it possesses over the ordinary pine sleepers, is that on a "Vignoles" road the spikes do not cut through the wood and open the gauge, as so often happens on curves of small radius with pine sleepers. This wood is now invariably employed for bridge timbers, sleepers, etc., on the railways of the River Plate, and could probably be shipped with advantage to other countries, for, although its first cost would be greater, its long life would in the end be more economical. It has certainly a much longer life than English oak.

Although at the first glance the River Plate, especially the Province of Buenos Ayres, may be thought a rather uninteresting country from an engineer's point of view, in connection with its railways, upon a closer examination it presents some features of considerable interest, and supplies useful data, which may be applied with advantage, not only in other parts of these vast plains, through which railways are being pushed more rapidly every day, but also in other countries of similar geological formation, if such exist.

Car Heating.

Mr. C. A. HOUSTON, who has been engaged as expert to investigate this question on behalf of the Atchison, Topeka & Santa Fé Railroad, has recommended the Emerson system of heating for that road, and his recommendations are said to have been adopted. The other systems examined were the Martin, Gold and Sewall. The following are his conclusions:

In the Emerson system, the main line of pipe is connected between the cars by a short steam hose made up on a spiral coil to keep the same in form. This short hose has the same or corresponding part of a metallic coupling fastened to each end, the other portions of the couplings being fixtures upon the ends of the pipe under each car. Thus the hose is detachable at both ends, and interchangeable, and when not in use may be detached from the car. These short hose are fitted in the shop, and may be carried as extras on trains, always ready for use. This connection is so made that, when it is properly covered, the condensation will be reduced to a minimum. It is cheap, and not liable to injury.

I was told by the officer in charge of the yard of the Connecticut River Railroad, at Springfield, Mass., upon which this system is in general use, that they had not burst or broken a single hose connection since they had used this style, nor had the same given any trouble. This I deemed a strong indorsement, as the trains on this road are local, and each car is used in several trains each day. Many arrangements of the pipes for radiation within the cars have also been tried on this road. The plan which gives best satisfaction to patrons of the roads is coils under the seats. They are very comfortable for short rides; for long routes this arrangement is not desirable. It is not comfortable to sit over a hot pipe all day, and there is an element of danger in these cross pipes in case of accident. This may be avoided by using only side radiators. This system uses an independent circulation on each side of the car. By this means it is possible to use one side at a time, and that the one which outward circumstances render the most advisable.

This system also comprises a small auxiliary boiler, placed under the car, into which the water from condensation drips. This boiler may be filled with water from the engine boiler through the steam pipes, and it is for use when a car is detached. It can be used successfully when needed. It may or may not be a part of the outfit, as experience proves its usefulness. These several systems all take steam for heating from the locomotive boiler. In either system steam may be taken from a boiler carried on a train for heating purposes should such an arrangement prove desirable. I am of the opinion, however, that with complete arrangements for utilizing the latent heat of the high pressure steam from the engine boiler, the cost of heating will be found so small that it will not be advisable to carry extras. This steam, carrying a high degree of latent heat, is perfectly safe for use. No scalding can result from breakage in the open air.

The Connecticut River Railroad placed a train at my disposal to test the quantity of steam used for heating. This test, made with four cars and during 12 hours of time, showed an average of steam condensation equal to about four-fifths of a horse-power per car. Of this condensation about one-third took place in the main line of pipe, which was not suitably protected, and two-thirds in the radiating pipes, which were not properly arranged for economy. This test was made during a cold March day. The cars were used in local runs. The doors were opened frequently and were not closed in reference to retaining heat in the cars. I wished to determine how much condensation could take place rather than how little would make the cars comfortable on that day. From this result, I am satisfied that cars can be warmed during a winter with an average of not to exceed three-fourths horse-power of steam per car. The cars of the Atchison lines, which are largely used in mild climates and in long runs, will require, as a maximum, very rarely more than one-half horse-power per car, and as a minimum, but little more than the surplus steam of the engine. This test was made with the Emerson system. For reasons which I have stated above, I recommend the Emerson system as the best. And with a plan of radiation suited to the conditions, and adapted to save every possible unit of heat, I have no doubt but that the adoption and use of this system will prove very satisfactory.

STATISTICS OF NEW WATER-WORKS CONSTRUCTION.

(*Specially Communicated.*)

CONTINUED FROM PAGE 247.

Minneapolis, Kan.—The works were commenced in April, 1887, and accepted on July 20, 1887; they were designed by B. R. CLARKE, and J. T. TALBOT was Constructing Engineer. The contractors were Turner, Clarke & Rawson, of Boston, Mass., and the pumping machinery was furnished by the Geo. F. Blake Manufacturing Co., of Boston. The direct pressure system is employed. The franchise is for 20 years and the price per hydrant is $55: it is owned by the Minneapolis Water Co.; President, GEO. A. RAWSON; Secretary, A. GILBERT; Superintendent, H. G. HOLDEN. The present population is estimated at 3,500.

Colorado Springs, Col.—The works were commenced in December, 1886, and are to be completed on the 15th of this month; they were designed by H. L. REID, City Engineer, who also acted as Constructing Engineer. The price paid for trenching was 20 cts. per lin. ft. and for pipe laying 5¼ cts. per ft. The franchise and works are owned by the city; F. E. DOW is Mayor. The Superintendent is EDWARD FROST. The present population is estimated at 8,000.

Mr. REID writes us as follows, under date of September 27:

"Colorado Springs is situated near the base of Pikes Peak; latitude 38°.49′ N., longitude 104°.51′ W.; elevation 6022 City Datum, and is fast becoming the great health resort of the west.

"The first water-works system was constructed in 1879, the supply being drawn from a stream 7 miles distant, which takes its rise from the natural springs fed by the melting snow of Pikes Peak, and consequently the city can boast of water cold, clear as crystal, and free from all organic impurities. The head of the water-works is 1,200 ft. above the city and is conveyed to the city by pipes; a distributing reservoir of 2,000,000 galls. capacity is situated on a plateau 1 mile from the city and 200 ft. above City Datum.

"The towns of Manitou and Colorado City receive their supply from this system. The steady increase of the population has called for a larger supply, and funds were voted in the fall of 1886 for this purpose, and the construction of the new distributing reservoir was commenced in December of that year. This reservoir is built, adjacent to the old one, in excavation and embankment, and has a capacity of 15,000,000 galls. Owing to the great expense which would be incurred by cementing the bottom, it was deemed advisable to try puddling, the nature of the soil being well adapted, all necessary material being found in the reservoir basin; puddling was placed to a depth of 2 ft. in thickness on the bottom, and this covered with a layer of clean gravel 18 ins. thick. At present this appears successful, as water has been standing in it for 6 weeks, and there is no sign of seepage. The inlet, outlet mains and waste pipe were passed through the line of contact with the natural surface and embankment, being thoroughly embedded in hydraulic cement, with a series of collars of the same material to prevent any possibility of water finding its way along the pipes. The new supply main is 16 ins. diameter, with a series of sub mains of 12, 10 and 8 ins., all of this in addition to the old system. The two systems can be connected or used independently. Cost of reservoir, $8,000; supply main, $28,000; total cost, $36,000.

"By careful observation it was found that during 5 months of the Summer of 1886 the amount of water used per hydrant system, was 250 galls. per capita per diem.; the greater part of this, however, was for irrigation and lawn sprinkling. In addition to these reservoirs, there is an irrigating canal affording a capacity of 5,000,000 galls. per diem. Plans and specifications have been drawn up for a system of sewerage for this city, and construction will be commenced in early Spring." Faithfully yours,

H. I. REID.

(TO BE CONTINUED.)

NOTE.—The above statistics of new construction are sent in response to special inquiries sent out by us to contractors, superintendents, engineers and others having to do with new works. We have a special blank for this service, and will be pleased to forward one or more on application. We invite co-operation in this special subject.

CONSTRUCTION NEWS.

Water.

New Water-Works.—*Massachusetts.*—Brookfield. The Water Committee has employed ARTHUR C. MOORE, of Sturbridge, to make surveys and report on a water supply.——Cambridge. The celebration of the completion of the Stony Brook water-works extension has been postponed from Oct. 20, to Nov. 3.——Southbridge. The Water Supply Co. will build at once a second reservoir, for higher service, with a capacity of about 9,000,000 galls. The plans were prepared by A. C. MOORE, of Sturbridge, who will have charge of the work.

New York.—Newark. Pipe is being delivered for the company and trenching will soon be commenced. The reservoir is being dug and the stand-pipe is in course of erection.——Westfield. A vote will be taken Oct. 15, on the proposition to bond the village for $40,000 for water-works.——Unadilla, N. Y. An increased water supply is wanted, either from an ordinary well or an artesian well. Address S. S. NORTH, Water Commissioner.

Maryland.—Baltimore. The Consumers' Water & Illuminating Co., which is to supply Woodberry and the vicinity, will build works with a daily capacity of 500,000 galls., and lay 8 miles of pipe: the stand-pipe will be 100 ft. high and 20 ft. diameter. The company proposes to establish gas-works and an electric light plant.

West Virginia.—Wheeling. A high service reservoir is to be built and the pipe system extended.——Weston. A system of water works is projected. Address the mayor.

Georgia.—Washington. Water-works are to be established. Address B. S. IRVIN, Mayor.——Marietta. A proposition to build water works has been made by PROCTOR LAWRENCE.

Tennessee.—Athens. Water-works are to be built. Address the Athens Mining & Manufacturing Co.——Chattanooga. Work is in progress on the stand-pipe, and the mains will be laid shortly.

North Carolina.—Charlotte. Water-works are contemplated and the City Council invites correspondence on the matter.

South Carolina.—Charleston. The Charleston Water-Works Co. will build an additional reservoir with a capacity of 5,000,000 galls.——Orangeburg. The water-works in the business locality are completed and in successful operation; the system will be extended to cover the entire city. Address J. B. ALDERGOTTI.

Alabama.—Bessemer. The new works, to be built by Scoville & Irwin, of Nashville, Tenn., will have a reservoir with a capacity of 4,000,000 galls., 5 miles of mains and a stand-pipe 100 ft. high and 20 ft. diameter.

Montreal, Canada.—At the meeting of the Water Committee last week, Alderman STEVENSON, Chairman of the Fire Committee, and Chief PATTON urged the necessity of an improved main service but were informed that while the committee was desirous of making the improvements asked for, nothing could be done this year owing to the want of funds. Superintendent LESAGE, however, had prepared a plan for improving the service which, if sanctioned by the City Council, would enable the work to be begun early next year. The plans call for about 24,050 ft. (1,084 tons) of 12-in. pipe and 2,250 ft. (158 tons) of 10-in. pipe. Mr. LESAGE remarked that this would cover a lot of the ground recommended in the Keefer scheme and would supply more than Alderman STEVENSON had suggested. It was decided to make reports to council recommending that tenders for the work be advertised for. The estimate of cost was as follows:

Pipe, say 1,200 tons at $36	$43,200
Specials, 50 tons at $50	2,500
Brass tubing, 4,000 lbs	1,200
Brass castings, 16,250 lbs.	4,062
Total	50,962

Gowanda, N. Y.—The water-works were completed and tested Oct. 8. The gravity system is adopted. The reservoir has a capacity of 3,000,000 galls., with a head of 73 lbs. per sq. in. There are 3.5 miles of 4, 6 and 8 in. pipe, fitted with Ludlow valves and hydrants. The works were commenced July 15 and finished Sept. 30, 1887. At the test the system was subjected to a pressure of 100 lbs. to the sq. in. without showing a defective joint or breaking a pipe; although this was the first time water had been let into the system. This is somewhat unusual, as it commonly happens that several pipes will prove defective through having been damaged by filling in or otherwise. The works are owned by the Gowanda Water-Works Co., and were designed and built by BASSETT Bros., engineers and contractors, Buffalo, N. Y.

The Sodom Dam.—The New Croton Aqueduct Commissioners, New York City, have adopted the plans for the construction of the east branch reservoir, or Sodom dam.

The Sunview Reservoir & Ditch Co., has been incorporated at Denver, Col., by E. G. Wormack, S. R Wormack and T. H. Lowe. The company proposes to construct ditches and 4 reservoirs on Little Fountain and Rock creeks in El Paso county. The capital stock is $50,000 and the office will be at Sunview, El Paso county, Col.

Drainage in Illinois.—An important drainage canal has been completed through the prairie lands known as Broadlands, in the southeastern part of Champaign county. The canal is 8 miles long and 25 ft. wide on top; it drains about 10 sections of rich prairie land, more than half of which was suitable only for grass, and renders it all fit for cultivation. It also affords an outlet for the drains on as many sections more. The adjacent lands, which were unsalable at an average valuation of $25 an acre, now readily command $45, and $50,000 worth, mostly in eighty-acre lots, changed hands within 6 weeks. The contractors for this job are now at work on another similar ditch south of Lost Grove. The work was done by a newly invented steam ditcher.

The town of Norway, in Racine county, has taken steps to construct a system of drainage for about 8,000 acres of swamp and overflowed lands adjacent to Wind lake and Muskego lake. A canal will be constructed from Great Muskego lake, in Waukesha county, south to Wind lake, in Racine county, from which it will follow the general course of what is known as the "outlet" to Fox river, in Rochester, a distance of 10 miles. The cost of the work is estimated at about $75,000, and land enough will be reclaimed to be worth $500,000.

Seeking Payment for Well Royalties.—The *Globe-Democrat*, St. Louis, Mo., had the following recently. "There is a lively row in progress in Wabash Co., Ind., over the attempted collection of drive-well royalties. A. B. SWITZER, of Peru, agent for W. D. Andrews & Brothers, owners of the Green patents has served notice on 200 owners of wells in Wabash county to meet him at the Sexton House, in North Manchester, on October 1, and pay the $10 royalty demanded for each domestic and farm well not exceeding 1¼ ins. diameter, or suit will be begun. A meeting of farmers was recently held at Auburn, Ind., to discuss the payment of drive-well royalties, and it was decided to pay the amount demanded and save further trouble. John Wickes, of North Manchester, and Mikesell and Lassell, of Wabash, put down most of the wells in this county, and the owners think these gentlemen should pay the royalties. The 200 well owners in the county have combined to fight the payment of the royalties to the bitter end. The United States Supreme Court, by a decision rendered in May last affirmed and sustained the validity of Green's patent."

Failure of a Water-Works Reservoir.—The clear water reservoir of the water-works at Atlanta, Ga. gave way Sept. 1, and flooded the grounds with 400,000 galls. of water, entailing a loss of several thousand dollars on the city and delaying the filtering process for some weeks. The reservoir is a basin with four walls, all built substantially of stone, brick and cement, with a hard thick cement bottom. It is located just south of the machinery and east of the water-works pond, and was built at an expense of about $10,000. On two sides the walls are built against solid ground, but on the other two they stand out alone, but in a short time dirt would have been packed against them until the basin would have appeared surrounded by solid dirt. The basin is about 25 ft. deep and is 95 ft. long by 45 ft. wide. It was built on two sides and one end of brick, and on the other end of large stone. At the bottom the walls were about 10 ft. wide and at the top about 3 ft. The basin was built as a part of the filtering process which is now being constructed, and had only been completed a few weeks before. Some leaks had been found and repaired, and the reservoir was being filled, and the water was within a few feet of the top when a third of the eastern end and half the southern end gave way. The basin has now been repaired and a trial made of the filters with satisfactory results.

The Salonica Gas Works Co. has been incorporated in London, England, to acquire the works and property of the company established at Salonica, in Turkey, under the name of the Société Anonyme Ottomane pour la Fabrication du Gas. The new company will purchase or acquire a contract for lighting the city with gas or other illuminant, and for erecting the necessary plant.

Memphis, Tenn.—The Equitable Gaslight Co., which was recently granted the right of way through the city for the mains, has purchased 25 acres of land in the southern portion of the city on which to erect the works. The price paid was $30,000. The engineer has made a survey of the contemplated lines, and work will be commenced this month. The principal stockholders are New York and Cincinnati capitalists.

Proposals Open.

Railroad.—For 16½ miles of road, no bridges, for the Midlothian, Manchester & Richmond Railroad, Mining & Lumber Co. JOHN E. TAYLOR, 1,115 Main street, Richmond, Va.

Gas Wells.—S. GOLDBACH, Treasurer, Beach Woods Natural Gas Co., Jeffersonville, Ind.

Railroad.—Bids for 100 miles; the 1st division from a point 20 miles south of Chattanooga, Tenn., to Rome, Ga.; the 2nd division from Cedartown, Tenn., to the terminus in Carroll county. Work to be commenced Nov. 1 and completed by June. J. D. WILLIAMSON, President, Chattanooga, Rome & Columbus R. R., Rome, Ga.

Retaining Wall.—Specifications on file. A. E. SMYRK, City Commissioner, Baltimore Md. October 18.

Water Stock.—Additional water stock for $3,000,000. EDWARD V. LOEW, Comptroller, New York City. October 18.

Street Work.—Grading and granite block paving. GEO. R. CONNER, Commissioner of City Works, Municipal Building, Brooklyn, N. Y. October 19.

Setting Boiler.—THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. October 20.

Sewers.—THE COMMISSIONER OF PUBLIC WORKS, (*as above*). October 20.

Timber.—About 85,000 ft. B. M., white oak, and 107,000 ft B. M. white pine dimension timber for repairs of locks and gates on Fox river, Wisconsin. Capt. W. L. MARSHALL, U. S. Engineer Office, Milwaukee, Wis. Oct. 20.

Post Office.—At Cayuga, Ont. A. GOBEIL, Secretary, Department of Public Works, Ottawa, Canada. Oct. 21.

Sewer.—St. A. D. BALCOMBE, Chairman, Board of Public Works, Omaha, Neb. October 21.

Boilers, Pumps, Hydrants, Heating Registers, Etc.—THE TRUSTEES OF THE HOSPITAL FOR THE INSANE Home Mutual building, San Jose, Cal. October 22.

Bridge and Stone.—Wrought-iron bridge with masonry, etc.; also 800 cu. yds. of broken stone. FRED RAINE, County Auditor, Cincinnati, O. October 22.

Paving Bonds.—Bonds for $7,500. JOHN RUSH, City Treasurer, Omaha, Neb. October 24.

Building.—Dog pound at foot of E. 102nd street. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. October 24.

Levee.—Levee work on the White river front; 400,000 cu. yds. Capt. SMITH S. LEACH, U. S. Engineer Office Memphis, Tenn. October 25.

Bridge.—Iron bridge, masonry substructure. Plans and specifications on file. FRED RAINE, County Auditor, Cincinnati, O. October 26.

Street Work.—Grading, macadamizing, curbing, paving, culverts, drains, etc., THOMAS C. SMITH, President, Board of Public Affairs, Cincinnati, O. October 27.

Court House.—At Louisville, Miss. Plans and specifications on file. JOHN F. SHARP, Clerk, Board of County Supervisors, Louisville, Winston county, Miss. November 7.

Contracting.

Electric Railway.—T. William Harris & Co., 2 Nassau street, New York City, have closed a contract for putting up poles, wires, etc., and starting up a new electric railway in Wilmington, Del.

Pipe Laying.—The Health Board of the town of Gravesend, N. Y., has awarded the contract for laying 3¾ miles of iron pipe for flushing the sewer, to Frank P. Gallagher, at $14,400.30; this was the lowest of the 8 bids received.

The Carolina Oil & Creosote Co. will considerably enlarge its works at Wilmington, N. C., and proposes to build works on the Pacific coast.

Railroad Material Wanted.—Engines, rails, etc., are required for a dummy railroad in Kentucky. Address Stuart & Co., Winchester, Ky.

Trenching and Pipe Laying.—The following proposals were received Oct. 7 by the Executive Board, Rochester, N. Y.:

	Andrew E. Hyde.	William Dyer.	George Chambers	N. L. Brayer.
Trenching.				
4,970 lin. ft.	$0.18	$0.20	$0.26	$0.29
Cast-Iron Pipe.				
510 lin. ft. of 10-in.	0.15	0.18	0.18	0.20
1,950 " " 8-in.	0.14	0.14	0.14	0.15
2,260 " " 6-in.	0.12	0.10	0.12	0.12
185 " " 4-in.	0.09	0.08	0.09	0.10
Lead Joints.				
Ten 10-in. addl., over 5.	0.45	0.50	0.20	0.05
" 8-in. " " 5.	0.40	0.50	0.20	0.05
" 6-in. " " 5.	0.32	0.50	0.20	0.05
Total	1,548.15	1,620.00	1,956.25	2,133.00

The contract was awarded to Andrew E. Hyde.

Flexible Water Pipe.—The contract for furnishing and laying a flexible-joint water pipe in New York harbor from Brooklyn, N. Y., to Governor's island, has been awarded by Capt. J. H. LORD, U. S. A., Governor's island, to John F. Ward, New York City, for $12,400, including meter and connections.

Slope Wall.—The following proposals for building 1,325 lin. ft. of slope wall at Corning, N. Y., have been received by JAS. SHANAHAN, Superintendent of Public Works: McGreavy & Murray, Elmira, N. Y., $7.88 per lin. ft.; Fitzpatrick & Noonan, Havana, N. Y., $8.90; Griffin & Gorton, Corning, N. Y., $9.25.

Canals.—The contract for the drainage of Frazier lake, Cal., by the construction of two canals to connect with the Pajara river, has been awarded to S. W. Sheldon, of San Francisco, at 30 cts. per cu. yd. The work is to be completed by January.

Iron Draw-Bridge for St. Domingo.—CONSTABLE BROS., Engineers and Architects, of 149 Broadway, New York, have recently furnished general plans, specifications and details for a wrought-iron draw-bridge for St. Domingo. While the design is thoroughly American the bridge will be built in Belgium, and thence shipped to its destination.

New Highway Bridges for Illinois.—At the September session of the Board of Supervisors of Champaign county, held at Urbana, Ill., the following bridge matters were brought forward: the bridge committee reported in favor of an appropriation of $625 to assist the town of Colfax in building 8 highway bridges over the East Lake Fork Drainage District; the cost of the bridges is estimated at $1,250, of which the town and county will each pay half. The highway commissioners of Rantoul petitioned for an appropriation of $840, the half cost of the erection of 4 bridges and embankment approaches over Salt Fork creek and branch. The highway commissioners of Stanton township petitioned for an appropriation of $800, half the estimated cost of an iron bridge over Salt Fork. The highway commissioners of St. Joseph petitioned for an appropriation of $1,250, half the estimated cost of a bridge and approaches over Salt Fork. A resolution was adopted with regard to the law relating to roads and bridges which went into effect July 1, 1887, and which recites that in order to obtain aid from the county to build a bridge and approaches thereto, the cost of said bridge shall exceed 20 cts. on each $100 on the assessment roll of the township asking aid, and that the tax levy for the two preceding years in said town for road and bridge purposes shall have been 60 cts. on the $100; the resolution was to the effect that in the judgment of the Board the law plainly defines the limit in cost to apply to each separate bridge and not to the total cost of two or more bridges.

Dam.—The contract for the dam and other work for the canal and the first water-gate of the Mokelumne Ditch & Irrigation Co. (office at Lodi, Cal.), near Burson, Calaveras county, has been awarded to Walker & Merwin, of Chico, Cal., for $17,072.

Dredging.—The following proposals for dredging about 1,200,000 cu. yds. of material in Galveston bay, have been received by Major O. H. ERNST, U. S. Engineer Office, Galveston, Tex.: Rittenhouse Moore, Mobile, Ala., 9⅛ cts. per cu. yd.; Geo. C. Fobes & Co., Mobile, Ala., 11⅞ cts.; B. Adone, Galveston, Tex., 12½ cts.; Wm. A. McGillis & Co., Kankakee, Ill., 14¼ cts.

Water Supply Tunnel.—The City Engineer of Chicago, Ill., will shortly advertise for bids for constructing so much of the new water tunnel as will be in the lake, 4 miles as contemplated, without any special reference to the ultimate location of the pumping works. The tunnel will be of brick, 8 ft. in diameter, and will have a daily capacity of about 100,000,000 galls. The cost of the lake end of the tunnel will be about $150,000 per mile and the pumping engines will cost about $500 000.

The Sutherland Land & Improvement Co. has been incorporated by capitalists of Omaha, Neb., to develop Sea Side, Fla. They will build a street railroad from Sea Side to Lake Butler, 4 miles, to be operated by steam motors; establish water-works, build saw mills, erect a large hotel and put a steamboat on the bay and another on the lake. The capital stock is $250,000. C. F. WALL, of Sea Side, is interested.

The Birmingham Bridge & Bolt Works Co. has been incorporated at Birmingham, Ala., with a capital stock of $100,000. It will acquire the plant of the Birmingham Bridge Co., which will take $20,000 stock. The Elyton Land Co. has subscribed for $20,000, and some New Orleans parties for $40,000.

Brick Sidewalk.—The following proposals for a brick sidewalk were received Oct. 6 by Cap. GEO. H. COOK, U. S. A., Davids Island, N. Y.: Fallon & Sheehan, New Rochelle, N. Y., 90 cts. per lin. ft.; Richard Cairow, Brooklyn, N. Y., $1.12 per lin. ft.; Murphy & Gillespie, New York $1,195 for the entire work. The contract was awarded to Fallon & Sheehan for 1,055 ft.

Cast-Iron Cylinders.—The following proposals for the cast-iron cylinders for the shafts of the new tunnel for the water-works, were received Oct. 6 by JOHN WHITELAW, Engineer and Superintendent of Water-Works, Cleveland, O.: Variety Iron Works, Cincinnati, 2⅞ cts. per pound; Iron Ship Building Co., 2.49 cts.; Bowler & Co., Cleveland, 3¼ cts.; Maher & Brayton, Cleveland, 3½ cts.; Cross Bros. & Schener, 3¾ cts.; Lake Shore Foundry, Cleveland, 4¼ cts.; Walker Manufacturing Co., lump sum, $12,660. The contract was awarded to the Variety Iron Works. The weight of the cylinders, 17 in number, is about 129 tons.

Bridge Contracts.—*Chicago, Ill.*—The contract for the 18th street viaduct has been awarded to the Keystone Bridge Co., Pittsburg, Pa., for $83,300. This will be paid for by the railroads; the Western Indiana paying $45,060 for the west span, and $29,270 for the east span; and the Chicago & Alton paying $8,970 for the plate girder span.

Kansas City, Mo.—The contract for a bridge over the belt line at Montgall avenue has been awarded to the Kansas City Bridge & Iron Co., at $1,446 for the superstructure, 25 cts. per cu. yd. for the excavation, and $8 per cu. yd. for rubble masonry.

St Paul, Minn.—The following were the bids for the bridge to connect Marshall Ave., St. Paul, and Lake Ave., Minneapolis: Superstructure: Wrought Iron Bridge Co., Canton, O., $109,100; Milwaukee Bridge Works, Milwaukee, Wis., $114,595; Horace E. Horton, Rochester, Minn., $115,000; Shiffler Bridge Works, Pittsburg, Pa., $129,000; King Iron Bridge & Manufacturing Co., Cleveland, O., $135,000; Smith Bridge Co., Toledo, O., $135,000; A. Gottlieb & Co., Chicago, Ill., $148,000; Union Bridge Co., Buffalo, N. Y., $156,590. The contract was awarded to the Wrought Iron Bridge Co.—Substructure: P. F. O'Halloran, $33,136.90; Thornton & Shaw, $33,264.50; Ring & Tobin, $32,851.50 (Mankato limestone), and $34,420.50 (Kettle River sandstone); P. Durack, $34,967.50; Minnesota Stone Co., $37,007.50; Lauer Bros., $38,903. The contract was awarded to F. P. O'Halloran. The engineer is J. S. SEWALL, of St. Paul.

Fond du Lac, Wis.—The following proposals for a highway bridge have been received: Massillon Bridge Co., Massillon, O., $550, $580; Wrought Iron Bridge Co., Canton, O.: $625, $567, $300, $465; Groton Bridge & Manufacturing Co., Groton, N. Y., $585, $700, $780, $675; A. Bayne & Co., Minneapolis, Minn., $600, $645, 695; Wisconsin Bridge & Iron Co., Milwaukee, Wis., $650, $690; Kansas City Bridge & Iron Co., Kansas City, Mo., $695, $689, $635, $600; Milwaukee Bridge Works, Milwaukee, Wis., $630; P. E. Lane, Chicago, $675; E. A. Spaulding, Dubuque, Ia., $710; King Iron Bridge & Manufacturing Co., Cleveland, O., $1,075 (with iron piers).

Calaveras County, Cal.—The California Bridge Co., of San Francisco, has the contract to build a county bridge across the Calaveras river at McGurks Crossing, at a cost of $3,000.

City Hall.—The following proposals for the superstructure of the new City Hall at Omaha, Neb., have been received by the Board of Public Works: Sholes & Co., $234,490; Brennan Bros., $259,640; Rice & Bassett, $261,473.83; James Griffith, $285,000; Cunningham & Ryan, $293,675; James Fox & Co., $360,387.50. Mr. E. E. MYERS, of Detroit, Mich., is the architect.

Water-Works for St. Andrews, New Brunswick.—As yet, nothing has been done with regard to the scheme for putting in water-works, and the attention of contractors is called to this place. Mr. T. MCGRATH writes us as follows: "The facilities for the work are very favorable; the water, a lake, is only 4 miles from the town and over 100 ft. above the sea level, so that no steam power will be required. I am anxious to find a firm or company that is engaged in such works, with a view of arranging to have the pipes laid. Besides the patronage of the town (of about 2,000 inhabitants), the supply of water is important in connection with a scheme to make St. Andrews a popular watering place or summer resort."

Stone.—The following proposals for furnishing stone for the construction of a lock in the Wabash river, near Mt. Carmel, Ill., have been received by Major AMOS STICKNEY, U. S. Engineer Office, Louisville, Ky.; (the two prices given are for delivery on top of the bank at the site of the lock, and at the railroad switch, near the river, at Mt. Carmel):

Bidders.	Specif'd Stone		Cut Stone, Dressed Face.		Cut Stone, Quarry Face.		Squared Stone and Backing.	
	Site	Switch	Site	Switch	Site	Switch	Site	Switch
I. V. Hoag, Jr., Cincinnati, O.	$21.00	$19.00	$15.00	$13.00	$13.00	$11.00	$11.00	$9.00
Salem Stone & Lime Co., Louisville, Ky.	—	20.15	—	17.65	—	16.65	—	11.40
E. Crumbo & J. Melcher, New Albany, Ind.	25.10	22.60	16.90	14.40	14.60	12.10	11.90	9.40
Charles E. Rees, Cincinnati, O.	20.87	19.12	15.87	14.12	12.87	11.12	8.87	7.12

The quantities required are 529, 950, 650 and 784 cu. yds. respectively.

Brooklyn Bridge Contracts.—For the iron and steel work for the extension of the Brooklyn approach to and across Nassau street only two bids were received; the New Jersey Steel & Iron Works, 5.57 cts. per lb. erected; Keystone Bridge Co., 7¾ cts. per lb. erected. The contract was awarded to the New Jersey Steel & Iron Works. The Dickson Manufacturing Co., of Scranton, Pa., has the contract for two switching engines, to weigh 44,000 lbs. in working order and to cost $5,500 each; they are to be delivered in December.

Railroad Contracts.—*Baltimore & Drum Point R. R.*—The contract for the construction of the line has been awarded to Rogers & Clement, of Baltimore, Md., whose headquarters will be at Lusby's Post Office, Calvert county, Md., for the present.

Virginia Midland R. R.—Jesse E. Adams, of Amhurst, Va., has the contract for improving the roadbeds of this line and the Ohio & Kanawha R. R.

Lynchburg & Durham R. R.—Codwise & Allen, of Rustburg, Va., have a contract for 3 miles of road.

Athens & Tellico R. R.—Young, Livingstone & Hall, of Athens, Tenn., have the contract for the first 2 miles.

Powell's Valley R. R.—The contract for the first 20 miles has been awarded to McDonald, Shea & Co., of Knoxville, Tenn., and the remainder of the work will be let shortly. This is the new road to be built from Knoxville to Cumberland Gap, where it will connect with the Louisville & Nashville. It will be 65 miles long.

Louisville, Cincinnati & Virginia R. R.—Garvey Bros. and Lee & Kennefick, of Winchester, Ky., have the contracts to build the road from Winchester to Beattyville.

Georgia Southern & Florida R. R.—Messrs. James Bros. and Col. W. J. Winn have grading contracts, and T. C. Hampton & Co., of Rutland, Ga., have contracts on the road until next May. The road is almost graded to Tifton on the Brunswick & Western R. R., and surveys are being made for the extension from Valdosta to Palatka, Fla., via Lake City and Gainesville. The road is now under contract from Macon, Ga., to Valdosta.

Eufaula & East Alabama R. R.—The contract for the extension from Clayton to Ozark has been awarded to Wright & Strothers, Box 734, Birmingham, Ala. The line will be about 40 miles long and is in the interest of the Central Railroad & Banking Co., M. S. BELKNAP, General Manager, Savannah, Ga.

Sheffield & Birmingham R. R.—Fudge & Kearns, of Jasper, Ala., have finished a grading contract of 12 miles and are at work on another contract 8½ miles long, leading into Jasper. They have 1,000 men and 300 teams at work.

Warrior Coal Fields R. R.—Dunn Bros., of Birmingham, Ala., have the contract for grading the line from Meridian, Miss., to Gainesville, Ala. The road will ultimately reach Decatur, Ala.

Arkansas, Kansas & Colorado R. R.—Streeter & Bradbury, of Denver, Col., have the contract for grading and bridging from Dodge City, Kan., southeast 30 miles to a new town named Buctline; the road to be completed by January.

Fort Worth & Denver R. R.—D. Carey and A. C. Sherrick & Co. have contracts on the branch, 14 miles long, to Panhandle (Carson county), Tex.

Mexican National R. R.—Hampson & Thornton have received permission to send their outfits over in bond from Laredo, Tex. They will begin work at once on the extension.

RAILROADS.

East of Chicago.

Existing Roads.—*St. Lawrence, Lower Laurentian & Saguenay.*—We are informed that 21½ miles of track has been laid on this Canadian road reported last week as under construction, and that 22 miles are under construction to Riviere Pierre on the Quebec & Lake St. John Ry. A line is also projected from Grand Piles to Three Rivers up the west bank of the Maurice river.

Boston & Maine.—The company has taken possession of the Boston & Lowell system, the lease of which was executed some months ago. As the success of the Hazen bill in the New Hampshire legislature seems now to be pretty well assured, the New Hampshire roads will probably soon be consolidated with it.—The Upper Coos road is now being graded between Colebrook and the Boundary.—The extension of the Rockport branch reported last week as surveyed is now reported completed and to be open for traffic at once.

Flint & Pere Marquette.—It is rumored that this Michigan company contemplates an extension from Manistee Junction to Grand Rapids, with branches to Muskegon and Petoskey, and will begin surveys at once.

International.—The survey is in progress of the branch from Cookshire, P. Q., to a connection with the Upper Coos road in New Hampshire reported last week as projected.

Pennsylvania.—This company, the Lehigh Valley and the Central of New Jersey have made an agreement concerning certain valuable terminal property at Communipaw, N. J., and extensive works are to be undertaken for its improvement.

New York, Pennsylvania & Ohio.—Surveys are in progress for a new entrance to Cleveland, O. The funds raised by the new $2,500,000 mortgage are to be used in double tracking the line from Cleveland to Youngstown, 80 miles.

Niagara Central.—This Canadian company, which was last week placed among New Projects and Surveys, should come under the head of Existing Roads, and its report of progress is as follows: Track laid, Niagara Falls to Thorold, 8 miles; under construction, Thorold to St. Catharines, 4 miles; projected, St. Catharines to Toronto, 75 miles. The first train ran into the town of Thorold on the 12th inst., in order to secure a bonus of $30,000, from that municipality.

New Projects and Surveys.—*Lake Erie, Essex & Detroit River.*—This Canadian line is under survey from Walkerville to Learington, a distance of 30 miles and construction is to begin soon, as the necessary funds are all secured.

HIRAM WALKER is President and JOHN MCAFEE of Harron is Chief Engineer.

Rome & Carthage.—The preliminary survey of this New York road has been completed, and the distance by the line run, was 70.73 miles. It is thought that capital can be secured to build the line.

Southern States.

Existing Roads.—*Powell's Valley.*—Work has begun on the grading of this road which is to extend from Knoxville, Tenn, to Cumberland Gap.

Tennessee Midland.—The company has made a second application for a $600,000 subscription to Davidson county, Tenn. The conditions of payment of the present application are the completion of the road east of Nashville to the Virginia State line. It is to be hoped the coming campaign will be less virulent than the first one.

Chatanooga, Rome & Columbus.—Sealed bids are called for by President J. D. WILLIAMSON for building the road from a point 20 miles south of Chatanooga, Tenn.,

to Rome, Ga.; and from Cedartown, Ga., to the terminus in Carroll county, the work to be completed by June 1, 1888.

Norfolk & Western.—The Clinch Valley extension, 115 miles in length, to connect with the Louisville & Nashville system, is being graded all along the line by a force of about 3000 hands.

Louisville & Nashville.—The report presented to the Annual stockholders meeting shows a very favorable condition of the company's affairs. During the year ending June 30, 1887, 74 miles of track were laid and the company has now under construction about 90 miles of extensions. About 180 miles more are to be placed under construction at once, which will make the total extent of the system about 3,980 miles.

Georgia Southern & Florida.—This line is now under contract from Macon to Valdosta, 175 miles, and a good portion of the grading is completed. The Florida terminus will probably be at Palatka, and surveyors are now at work between that point and Valdosta.

Louisville, St. Louis & Texas.—This road is now reported under contract from Owensboro to Henderson, Ky.

Jacksonville, Tampa & Key West.—The St. Augustine & East Coast Ry. Co. has been incorporated in Florida to extend the Jacksonville, St. Augustine & Halifax railroad to Daytona.

Kanawha & Ohio.—It is reported that this road is to become part of the Newport News & Mississippi Valley system.

New Projects and Surveys.—*Wheeling Wellsburg & State Line.*—This West Virginia company is obtaining stock subscriptions and right of way. SAMUEL GEORGE of Wellsburg is President.

Montgomery, Hayneville & Camden.—This Alabama company has been referred to in our correspondence column of the issue of Oct. 1. W. BREWER of Hayneville is interested.

Selma & Cahaba Valley.—This proposed Alabama road is to be surveyed at once from Selma to Birmingham. R. M. NELSON of Selma is President.

Mobile, Hattiesburg & Jackson.—Hon. JOHN KEMPER of Enterprise, Miss., is interested in the construction of this proposed road. An attempt will probably be made to obtain subsidies along the proposed route.

Owensboro, Falls of Rough & Green River.—This company has been organized at Owensboro' Ky., and preliminary surveys are to be made at once. The line will be about 35 miles in length, R. S. TRIPLETT is interested.

Alabama & Northwestern.—This company has been incorporated to build a railroad from Montgomery, Ala., to Tupelo, Miss. G. W. WOOLFOLK is interested.

Missionary Ridge.—D. C. MCMILLIN, Jr., of Chattanooga, Tenn., is interested in a proposed railroad, 7 miles in length along the summit of Missionary Ridge.

The Northwest.

Existing Roads.—*Red River Valley.*—The situation at Winnipeg remains unchanged. The Government authorities claim to be still in hope of floating the Provincial bonds.

Northern Pacific.—The Duluth & Manitoba extension from Grand Forks to Pembina has been completed and opened for business, although its northern connection is still in the doubtful condition already reported.

St Paul Minneapolis & Manitoba.—Great Falls, Montana, is to celebrate October 13, the completion of the Manitoba line to that point, 543 miles west of Minot, the terminus at the opening of the season, and 1,070 miles from St. Paul.——Grading is making rapid progress on the Willmar & Sioux Falls line.——A surveying corps are reported running a line from Pierre, Dak. west to the Black Hills.

Minnesota & Northwestern.—The surveyors are making good progress with work on the Duluth extension.

Minneapolis Sault Ste Marie & Atlantic.—A survey is in progress for a branch to Florence, Wis., about 25 miles from the main line.

Chicago, Burlington & Quincy.—On the Cheyenne extension, track is laid to a point 30 miles west of Sterling, Col.

Chicago & Northwestern.—It is reported that a line is to be surveyed this fall from Mitchell to Harold, Dak.

Forest City & Watertown.—This Dakota road is being graded from Forest City, Dak., to Aberdeen. About 20 miles of line is nearly ready for the rails.

New Projects and Surveys.—*Lincoln Red Oak & Des Moines.*—This company has been incorporated by capitalists of Lincoln, Neb., to build a railroad to a point on the Missouri river in Cass county. I M. RAYMOND is interested.

Minnesota & Dakota.—It is reported that this company has made surveys for a railroad from Hawley, Minn., via., Caledonia, Dak., and Sherbrooke, to Devil's Lake and that a line is to be located from Sherbrooke to Fargo. The President of the company is HENRY CUTLER and the headquarters are to be at Fargo.

Duluth, Red Wing & Southern.—The Sioux City & Northeastern company will probably unite its interests with this company.——The officers of the company are in New York City trying to obtain funds for construction.

The Southwest.

Existing Roads.—*Chicago, Rock Island & Pacific.*—On the southwestern extension, track is laid to Wellsford, Kan., 339½ miles, from St. Joseph. On the Clay Centre line, track is laid from McFarland Junction to Grant, 35 miles. On the Salina line, track is laid from Herrington to Enterprise, 14 miles. On the Denver extension, the track has reached Mankato, 45 miles from Fairbury Junction. This makes the total mileage of the Chicago, Kansas & Nebraska, 723 miles.

Atchison, Topeka & Santa Fé.—The following new branches are reported completed and in operation in Kansas:—Mulvane extension, from Spivey to West Haven, Comanche county; Larned extension, from Burdett to Jetmore; Strong City extension, from Gladstone to Manchester; Ellinor extension, from Ellinor to Bazar; Benedict extension, from Toronto to Madison; Augusta extension, from Augusta to Mulvane; the Southern Kansas & Panhandle railroad, from the east line of Clark county to Ashland. Grading is progressing on the St. Joseph & Santa Fé, and the line is to be ready for tracklaying by Nov. 1.

Kansas City, Wyandotte & Northwestern.—The tracklaying has been completed to Valley Falls, Kan., 72 miles from Wyandotte.

Fort Worth & Rio Grande.—This Texas road is now in operation to Granbury, 40 miles from Ft. Worth. The surveys have been made to San Angelo, 165 miles farther, and grading is to begin at once.

Galveston, Sabine & St. Louis.—The new name of this Texas road is the Texas, Sabine Valley & Northwestern. The line is to be extended south to Sabine Lake and north to Paris.

Denver, Texas & Forth Worth.—Trains are now running from Fort Worth, Tex., to Clarendon, 267 miles. Track is reported laid 260 miles from Fort Worth.

Chicago, St. Paul & Kansas City.—On the St. Joseph extension track is laid from Des Moines, Ia., southwest 65 miles.

Kansas City, Texarkana & Gulf.—This company, which has just filed articles of incorporation in Arkansas, is successor to the Texarkana Northern Company, the proposed line of which extends from Texarkana to Fort Smith. The line is to be constructed by a syndicate headed by President HINCKLEY, of the St. Louis Kansas City & Colorado.

Pine Bluff, Monroe & New Orleans.—Surveyors are working on the contemplated extension from Pine Bluff, Ark., to Monroe, La., 120 miles.

New Projects and Surveys.—*Montana, Kansas & Texas.*—To those who have noticed our recent comments on this Kansas project, the following letter will explain itself.

SYRACUSE, Kan. Oct., 1, 1887.

I notice in your issue of Sept. 10, 1887, that you copy a part of an extract from the St. Louis *Globe Democrat*, saying that "This project includes a line from Galveston, Tex., to Miles City, Montana, about 1500 miles," "that part of the line is located, and the survey is in progress," which is correct. I will say for the benefit of your readers, that we have our road located through the State of Kansas; that we have about 50 miles of telegraph line up and in operation; that the Western Union Telegraph Co. are financially interested in the construction; that we have our surveyors in the field locating; that we have a large force of men at work constructing the telegraph line; that we expect to have in operation this season over 200 miles of telegraph line, and hope to commence grading in the Spring. Knowing your desire to mention all honest enterprises of this kind favorably and not misrepresent, I send you this statement in justice to yourselves, as well as myself.

Very respectfully,
A. L. TOMBLIN, President.

We publish the above that we may do full justice to those interested in the above project and shall be glad to receive any further information of the progress of work at any time. If Mr. TOMBLIN will turn to page 198 of our issue of Sept. 17, he can read at leisure our opinion of Kansas railway projects in general. We trust the enterprise of which he is the head will prove an exception to the general rule there stated, and that our front cover page will soon bear his call for sealed proposals for constructing his road.

Chicago, Kansas & Arkansas.—The first 20 miles of the road in Doniphan county, Kan., have been located and are to be put under contract at once. JOSEPH BROADDUS is Chief Engineer.

Denison & Washita Valley.—This company is reported as about to begin the construction of a railroad from Denison, Tex., north 50 miles to coal mines in Indian Territory. A. H. COFFIN, of Denison, is Secretary.

Garden City Nickel Plate.—It is reported that grading has begun on this line at Garden City, Kan., and that it is to run from Hays City south to the Texas panhandle. It is stated that the Union Pacific is interested in the project.

Kansas City & Sabine Pass.—This company has been reported as making extensive surveys near Kansas City. In a recent suit to obtain a part of the right of way of the Kansas City & Southern Railroad, they were defeated. HARRISON M. JAMES, of Kansas City, is President.

Wichita & Newton Rapid Transit.—This company has been incorporated by citizens of Newton, Kan., to build a railroad to Wichita, about 27 miles.

Hannibal & St. Joseph.—H. W. YATES, of Kansas City, contemplates building a branch 5 miles in length from near St. Joseph to Lake Contrary.

Rocky Mountain and Pacific.

Existing Roads.—*Atchison, Topeka & Santa Fe.*—It is stated that the force which has just completed the Denver & Santa Fé line from Pueblo to Denver is to begin the construction at once of the proposed line from Las Vegas, N. M., *via* Santa Fé to Gallup, which will considerably shorten the through line to the Pacific coast. The Kiowa extension, when completed west to a connection with the Main line, will give another saving in distance; the combined saving by the two cut-offs will be about 100 miles. The Colorado Midland is now running trains from Denver to Leadville over the newly completed road and the track is laid beyond Leadville nearly to Aspen.

Denver & Rio Grande.—The extension to Glenwood Springs has been completed, and tracklaying is being pushed toward Aspen, 40 miles distant.

Silverton.—Tracklaying is in progress on this Colorado narrow gauge road, 12 miles in length, from Silverton to Red Mountain.

Chicago, Rock Island & Pacific.—Reports from the engineers locating lines in New Mexico and Colorado indicate a line from Trinidad, Col., southwest to Santa Fé and El Paso, while the Pacific extension runs west from Chamita, 30 miles above Santa Fé. It is stated that grading will begin on these lines by the first of the coming year.

Union Pacific.—The company will probably do little in the way of extensions until the Government investigation is over, but the proposed extensions to Chicago and Los Angeles are being discussed. The Idaho Central, which is now completed to Boise City, will probably be pushed on east 50 miles. The division of territory reported as agreed upon with the Northern Pacific managers, includes the territory south of the mouth of Snake river.

Denver & Rio Grande Western.—The managers of this line propose to widen the gauge at an early date, and are also reported to favor the Salt Lake City project for a line to the Pacific coast.

Southern Pacific.—Surveyors are at work on the line from San Luis Obispo to Templeton. On the extension from Santa Barbara up the coast, about 400 hands are at work. Graders are also working on the Santa Rosa & Carquinez, the San Pablo & Tulare, and the Shingle Springs & Placerville extensions.

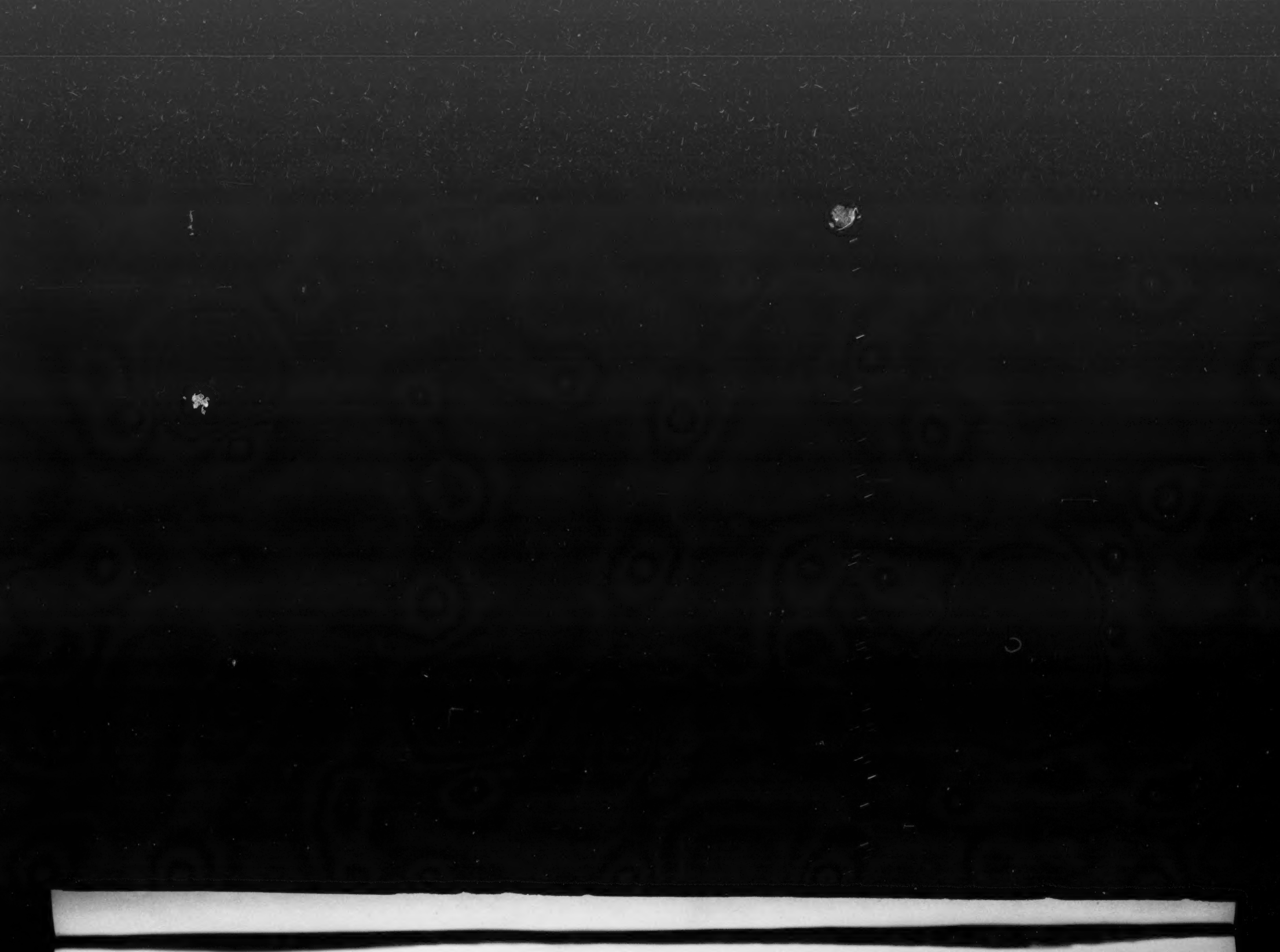
Mexican Central.—About 40 miles of track has been laid on the Guadalajara branch, and the line is graded 240 miles farther.

Mexican National.—The rainy season has delayed work on this road; but as that is about over, the grading contractors will soon push the work all along the line.

New Projects and Surveys.—*San Francisco & San Joaquin Valley.*—This company are reported to have secured the right of way for 75 miles of their proposed line from Bakersfield, Cal., to Mojave. J. R. WILBUR, of San Francisco, is interested.

Colorado Southern.—This company has been incorporated in Colorado to build a railroad from Pueblo to Del Norte. CHAS. H. MARR, Florence, Col., is interested.

Marysville & Nevada City.—A railroad is proposed between these California towns, a distance of 20 miles. JAS. O'BRIEN, of Smartville, is interested.

Sinaloa & Sonora Coast.—It is reported that funds are being solicited in Philadelphia for this proposed Mexican road. The line is to run from Mazatlan to Hermosillo with a branch to Durango.

Delagoa Bay Railway.—This African road is in operation, and is being ballasted prior to being delivered over by the contractor to the Delagoa Bay & East African Ry. Co. This has been quick work, and has already made great changes in Delagoa Bay, which is rapidly becoming the great shipping port of South Africa. At Lourenzo Marques all is activity and energy. The money to build the extension of the Delagoa Bay line by a German Dutch company has all been deposited, and the engineers of the extension are busy laying out the line, on which active work is already commencing. If the Dutch contractors do as good work on their line as Sir THOMAS TANCRED has on the Delagoa, the extension will reach Barberton in March and Pretoria by this time next year. There are already many thousands of tons of freight waiting for the formal opening of the Delagoa Bay line. The price fixed for freight is from $20 to $30 per ton, being a saving over the other routes to the mines of from $50 to $60 per ton. This will greatly facilitate mining in the Transvaal. The Germans propose extending their steamship lines so as to touch the Delagoa Bay.—*London Financial News.*